

A decorative geometric shape, resembling a stylized star or a cluster of overlapping triangles, is located on the left side of the slide. It is light gray and semi-transparent.

Non-CE6: JVET-N0161

Implicit transform selection based on intra mode

Xiaoqiang Cao, Fangdong Chen, Li Wang

Hikvision

Introduction

■ Implicit MTS in VTM-4.0

- If $w=1$ or $h=1$, only vertical or horizontal transform
- If $w=2$ or $w \geq 32$, $t_H = \text{DCT2}$
- If $h=2$ or $h \geq 32$, $t_V = \text{DCT2}$
- Otherwise, transform is selected as in following table:

TU block shape	t_H	t_V
$W=H$	DST7	DST7
$W>H$	DCT2	DST7
$W<H$	DST7	DCT2

Proposed Implicit MTS method 1

- implicit MTS based on intra mode
 - Same size restriction as original implicit MTS.
 - transform is selected as in following table:

Intra mode	t_H	t_V
Planar	DST7	DST7
DC	DCT2	DCT2
Ang. [2-34] && even Ang. [35-66] && odd	DST7	DCT2
Ang. [2-34] && odd Ang. [35-66]&& even	DCT2	DST7

Proposed Implicit MTS method 2

- implicit MTS based on intra mode
 - Same size restriction as original implicit MTS.
 - transform is selected as in following table:

Intra mode	t_H	t_V
Planar Ang. [2-66] && odd	DST7	DST7
DC	DCT2	DCT2
Ang. [2-34] && even	DST7	DCT2
Ang. [35-66] && even	DCT2	DST7

Proposed unified implicit MTS&ISP

- unification 1: using original ISP transform selection
 - Same size restriction as original implicit MTS.
 - transform is selected as in following table:

Intra mode	t_H	t_V
Planar Ang. 31,32,34,36,37	DST7	DST7
DC Ang. 33, 35	DCT2	DCT2
Ang. 2, 4, 6...28,30 Ang. 39,41,43...63,65	DST7	DCT2
Ang. 3,5,7...27,29 Ang. 38,40,42...64,66	DCT2	DST7

- Unification 2: using proposed method 1
- Unification 3: using proposed method 2

Experimental Results for implicit MTS

■ With proposed Method 1

	All Intra Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.13%	0.19%	0.15%	102%	101%
Class A2	-0.16%	0.07%	0.05%	101%	101%
Class B	-0.25%	0.19%	0.19%	100%	100%
Class C	-0.21%	-0.03%	0.04%	103%	102%
Class E	-0.32%	0.11%	-0.04%	101%	100%
Overall	-0.22%	0.11%	0.09%	101%	101%
Class D	-0.28%	-0.12%	0.07%	102%	103%
Class F	-0.07%	0.07%	0.09%	101%	101%

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.05%	-0.17%	0.03%	99%	100%
Class A2	-0.04%	0.08%	0.14%	99%	100%
Class B	-0.03%	0.13%	0.38%	100%	99%
Class C	-0.06%	0.29%	-0.02%	100%	101%
Class E					
Overall	-0.05%	0.10%	0.15%	100%	100%
Class D	-0.15%	0.04%	-0.22%	100%	101%
Class F	-0.03%	-0.01%	-0.18%	100%	101%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.02%	0.26%	-0.66%	100%	101%
Class C	-0.07%	-0.21%	-0.46%	100%	101%
Class E	0.06%	-0.73%	-0.08%	100%	100%
Overall	-0.02%	-0.15%	-0.45%	100%	101%
Class D	-0.07%	0.82%	0.21%	100%	101%
Class F	-0.15%	0.62%	-0.18%	100%	99%

Experimental Results for implicit MTS

■ With proposed Method 2

	All Intra Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.26%	-0.07%	-0.17%	102%	101%
Class A2	-0.21%	-0.14%	-0.18%	101%	102%
Class B	-0.29%	-0.04%	-0.03%	100%	100%
Class C	-0.21%	-0.22%	-0.04%	102%	103%
Class E	-0.38%	-0.32%	-0.37%	101%	100%
Overall	-0.27%	-0.15%	-0.14%	101%	101%
Class D	-0.27%	-0.29%	-0.20%	102%	102%
Class F	-0.12%	-0.11%	-0.14%	101%	100%

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.08%	-0.31%	-0.08%	100%	100%
Class A2	0.00%	0.00%	0.00%	100%	100%
Class B	-0.04%	-0.02%	0.09%	100%	100%
Class C	-0.09%	0.34%	-0.15%	100%	100%
Class E					
Overall	-0.05%	0.02%	-0.02%	100%	100%
Class D	-0.09%	-0.24%	0.03%	100%	100%
Class F	-0.09%	-0.03%	-0.28%	100%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.03%	-0.09%	-0.52%	100%	100%
Class C	-0.08%	-0.36%	-0.32%	100%	102%
Class E	0.19%	-1.56%	0.18%	100%	101%
Overall	0.01%	-0.55%	-0.28%	100%	101%
Class D	-0.03%	0.13%	-0.16%	101%	101%
Class F	-0.17%	-0.07%	-0.11%	100%	99%

Experimental Results for unification

■ Unified implicit MTS and ISP with original ISP scheme

	All Intra Main10						Random access Main10				
	Over VTM-4.0+implicitMTS_ON						Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT		Y	U	V	EncT	DecT
Class A1	-0.16%	0.12%	0.15%	102%	102%	Class A1	-0.04%	-0.14%	-0.11%	100%	100%
Class A2	-0.18%	0.12%	0.03%	101%	101%	Class A2	-0.03%	0.22%	0.07%	100%	100%
Class B	-0.27%	0.21%	0.17%	100%	99%	Class B	-0.03%	0.18%	0.16%	100%	100%
Class C	-0.22%	-0.02%	0.08%	102%	102%	Class C	-0.05%	0.22%	0.11%	100%	100%
Class E	-0.33%	0.03%	-0.04%	101%	100%	Class E					
Overall	-0.24%	0.10%	0.09%	101%	101%	Overall	-0.04%	0.14%	0.07%	100%	100%
Class D	-0.29%	-0.06%	0.09%	101%	100%	Class D	-0.16%	-0.01%	-0.22%	101%	101%
Class F	-0.09%	-0.08%	-0.01%	101%	102%	Class F	-0.04%	0.02%	-0.14%	100%	100%

	Low delay B Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.04%	-0.21%	-0.37%	100%	100%
Class C	-0.05%	-0.21%	-0.19%	100%	102%
Class E	0.03%	-2.07%	-0.14%	101%	102%
Overall	-0.03%	-0.68%	-0.25%	100%	101%
Class D	-0.08%	0.02%	-0.09%	100%	99%
Class F	-0.07%	-0.36%	0.08%	100%	100%

Experimental Results for unification

■ Unified implicit MTS and ISP with proposed method 1

	All Intra Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1	-0.13%	0.18%	0.12%	102%	101%
Class A2	-0.17%	0.11%	0.06%	101%	100%
Class B	-0.25%	0.19%	0.22%	100%	99%
Class C	-0.22%	-0.01%	0.02%	102%	102%
Class E	-0.31%	0.06%	-0.01%	101%	99%
Overall	-0.22%	0.11%	0.10%	101%	100%
Class D	-0.28%	-0.02%	0.15%	102%	106%
Class F	-0.06%	0.06%	0.02%	101%	101%

	Random access Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.18%	-0.02%	100%	102%
Class A2	-0.04%	0.33%	0.04%	100%	101%
Class B	-0.02%	0.15%	0.38%	100%	100%
Class C	-0.05%	0.39%	-0.02%	100%	101%
Class E					
Overall	-0.03%	0.19%	0.13%	100%	101%
Class D	-0.12%	-0.02%	0.00%	100%	102%
Class F	0.00%	0.07%	-0.10%	100%	100%

	Low delay B Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.01%	-0.10%	-0.56%	100%	101%
Class C	-0.06%	0.06%	-0.33%	100%	102%
Class E	-0.04%	-0.70%	0.54%	100%	102%
Overall	-0.03%	-0.20%	-0.21%	100%	101%
Class D	-0.04%	-0.03%	-0.45%	100%	100%
Class F	-0.14%	0.25%	0.90%	100%	101%

Experimental Results for unification

■ Unified implicit MTS and ISP with proposed method 2

	All Intra Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1	-0.26%	-0.12%	-0.14%	102%	101%
Class A2	-0.20%	-0.18%	-0.20%	101%	101%
Class B	-0.27%	-0.12%	-0.09%	101%	99%
Class C	-0.17%	-0.26%	-0.11%	103%	103%
Class E	-0.37%	-0.34%	-0.45%	101%	100%
Overall	-0.25%	-0.20%	-0.18%	101%	101%
Class D	-0.24%	-0.25%	-0.15%	102%	106%
Class F	-0.10%	-0.12%	-0.21%	101%	101%

	Random access Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1	-0.08%	-0.25%	-0.20%	100%	101%
Class A2	0.02%	0.16%	0.04%	100%	102%
Class B	-0.04%	0.02%	0.05%	100%	100%
Class C	-0.09%	0.16%	-0.12%	100%	100%
Class E					
Overall	-0.05%	0.03%	-0.05%	100%	101%
Class D	-0.11%	-0.11%	-0.21%	100%	101%
Class F	-0.11%	-0.09%	-0.15%	100%	101%

	Low delay B Main10				
	Over VTM-4.0+implicitMTS_ON				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.04%	0.06%	-0.38%	101%	101%
Class C	-0.09%	-0.29%	-0.28%	100%	101%
Class E	0.14%	-0.59%	0.38%	100%	101%
Overall	-0.01%	-0.22%	-0.16%	100%	101%
Class D	-0.06%	0.31%	0.23%	100%	100%
Class F	-0.15%	0.47%	-0.08%	101%	101%

Conclusion

- This contribution proposed 2 implicit MTS methods:
 - method 1: all angular mode with parity switching mechanism.
 - method 2: on top of method 1, all odd angular mode fixed with (DST7,DST7).

- This contribution also proposed 3 unifications between implicit MTS and ISP transform.
 - Unification 1: with original ISP transform method.
 - Unification 2: with proposed method 1.
 - Unification 3: with proposed method 2.

Conclusion

■ Summary Experimental results :

	All Intra Main10					Random access Main10					Low delay B Main10				
	Over VTM-4.0					Over VTM-4.0					Over VTM-4.0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Method1	-0.22%	0.11%	0.09%	101%	101%	-0.05%	0.10%	0.15%	100%	100%	-0.02%	-0.15%	-0.45%	100%	101%
Method2	-0.27%	-0.15%	-0.14%	101%	101%	-0.05%	0.02%	-0.02%	100%	100%	0.01%	-0.55%	-0.28%	100%	101%
unfication1	-0.24%	0.10%	0.09%	101%	101%	-0.04%	0.14%	0.07%	100%	100%	-0.03%	-0.68%	-0.25%	100%	101%
unfication2	-0.22%	0.11%	0.10%	101%	100%	-0.03%	0.19%	0.13%	100%	101%	-0.03%	-0.20%	-0.21%	100%	101%
unfication3	-0.25%	-0.20%	-0.18%	101%	101%	-0.05%	0.03%	-0.05%	100%	101%	-0.01%	-0.22%	-0.16%	100%	101%

- It is recommendable to be adopt into the VTM.
- Thanks HHI for the cross-checking.