

[JVET-L0152]

Simplification of PDPC

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Introduction

❑ Position-dependent intra prediction sample filtering in VTM2

- ❖ DC, Planar, H/V, less than ANG11, greater than ANG57
- ❖ For all block sizes
- ❖ Prediction lines for filtering are determined by block size

$$nScale = ((\text{Log2}(nTbW) + \text{Log2}(nTbH) - 2) \gg 2)$$

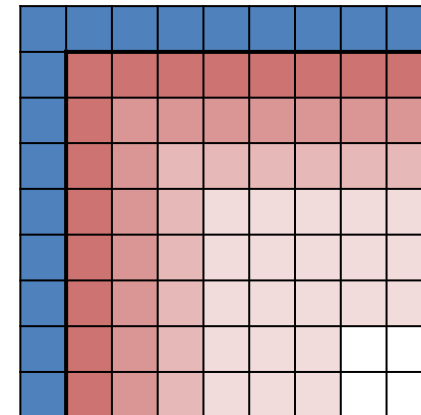
$$wT[y] = 32 \gg ((y \ll 1) \gg nScale)$$

$$wL[x] = 32 \gg ((x \ll 1) \gg nScale)$$

$$P(x, y) = (wL \times R_{-1, y} + wT \times R_{x, -1} - wTL \times R_{-1, -1} + (64 - wL - wT + wTL) \times P(x, y) + 32) \gg 6$$

Number of prediction lines for PDPC

S = Width + Height	nScale	Lines in VTM 2.0
$S \geq 64$	2	12
$16 \leq S < 64$	1	6
$S < 16$	0	3



An example of 8x8

Proposal 1

❑ Block size restriction

- ❖ PDPC is not applied when width or height is 64
 - Maximum block size for PDPC is 32x32
- ❖ Reduced prediction lines for PDPC by modifying scale value

$$nScale = ((\text{Log2}(nTbW) + \text{Log2}(nTbH) - 2) \gg 2)$$

↓

$$nScale = (\text{Log2}(nTbW) + \text{Log2}(nTbH)) > 6 ? 1 : 0$$

Number of prediction lines for PDPC			All Intra Main10					
			Over BMS-2.0.1 (VTM cfg)					
			Y	U	V	EncT	DecT	
S = Width + Height	VTM 2.0	Proposed	Class A1	-0.02%	-0.03%	0.04%	100%	97%
S > 64	12	-	Class A2	-0.09%	-0.03%	-0.02%	98%	99%
S = 64	12	6	Class B	0.00%	-0.04%	0.05%	99%	99%
16 < S < 64	6	6	Class C	-0.04%	-0.01%	0.15%	100%	100%
S = 16	6	3	Class E	-0.09%	0.01%	-0.15%	100%	99%
S < 16	3	3	Overall	-0.04%	-0.02%	0.03%	100%	99%
			Class D	-0.02%	0.12%	-0.08%	100%	100%

Proposal 2

❑ Removal of interpolation

❖ In angular mode, bilinear interpolation is performed for

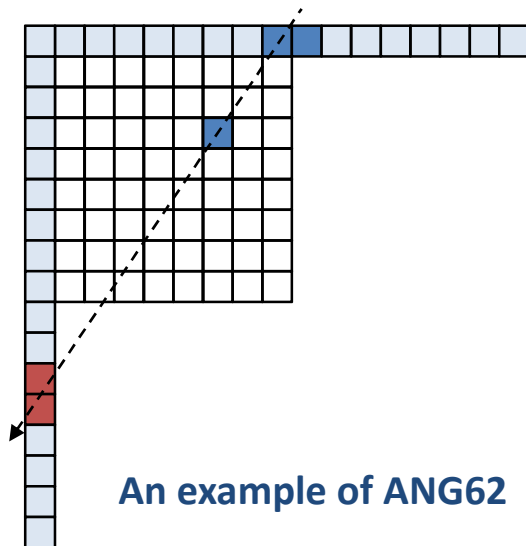
➤ Prediction and PDPC

❖ Remove bilinear interpolation in PDPC

$$\text{refT}[x][y] = (\text{dX}[x][y] < \text{refW} - 1) ? ((64 - \text{dXFrac}[y]) * \text{mainRef}[\text{dX}[x][y]] + \text{dXFrac}[y] * \text{mainRef}[\text{dX}[x][y] + 1] + 32) >> 6 : 0$$

⇓

$$\text{refT}[x][y] = (\text{dX}[x][y] < \text{refW} - 1) ? \text{mainRef}[\text{dX}[x][y]] : 0$$



An example of ANG62

	All Intra Main10				
	Over BMS-2.0.1 (VTM cfg)				
	Y	U	V	EncT	DecT
Class A1	0.02%	0.06%	0.04%	100%	100%
Class A2	0.01%	0.02%	0.06%	100%	100%
Class B	0.03%	0.04%	0.19%	100%	100%
Class C	0.00%	0.11%	0.35%	101%	100%
Class E	0.02%	0.12%	-0.01%	100%	100%
Overall	0.02%	0.07%	0.15%	100%	100%
Class D	0.02%	0.20%	-0.14%	100%	100%

Proposal 3

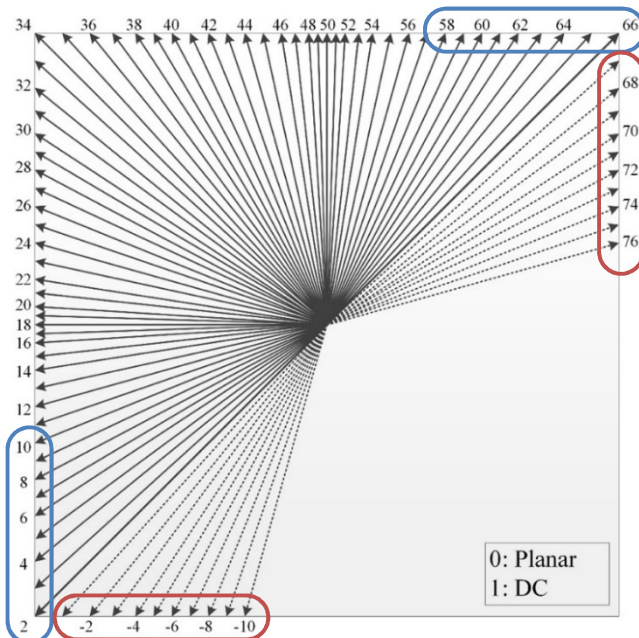
❑ Restriction on wide angle intra prediction (WIP) modes

- ❖ By harmonizing PDPC and WIP, PDPC is applied to **WIP modes**
- ❖ PDPC is restricted on WIP modes

8.2.4.2.7 Specification of INTRA_ANGULAR2..INTRA_ANGULAR66 intra prediction modes

...

Outputs of this process are ~~the modified intra prediction mode predModeIntra~~ and the predicted samples $\text{predSamples}[x][y]$, with $x = 0..nTbW - 1$, $y = 0..nTbH - 1$.



All Intra Main10					
Over BMS-2.0.1 (VTM cfg)					
	Y	U	V	EncT	DecT
Class A1	0.04%	0.03%	0.02%	100%	101%
Class A2	0.04%	0.02%	-0.02%	100%	101%
Class B	0.02%	0.00%	-0.05%	100%	101%
Class C	0.00%	-0.09%	0.04%	100%	101%
Class E	0.05%	-0.07%	-0.16%	100%	101%
Overall	0.03%	-0.02%	-0.03%	100%	101%
Class D	-0.03%	0.17%	-0.16%	100%	101%

Proposal 4

❑ Combination of the proposed three simplifications

- ❖ Proposal 1: Block size restriction
- ❖ Proposal 2: Removal of interpolation
- ❖ Proposal 3: Restriction on WIP modes

	All Intra Main10				
	Over BMS-2.0.1 (VTM cfg)				
	Y	U	V	EncT	DecT
Class A1	0.02%	0.07%	0.09%	99%	97%
Class A2	-0.06%	-0.02%	-0.01%	98%	99%
Class B	0.00%	-0.03%	0.00%	99%	99%
Class C	-0.04%	-0.12%	0.11%	100%	99%
Class E	-0.06%	-0.07%	-0.18%	99%	98%
Overall	-0.03%	-0.04%	0.01%	99%	99%
Class D	-0.05%	0.10%	-0.25%	100%	99%

Conclusions

❑ Experimental results

Proposal		Y	U	V	EncT	DecT
P1 (Block size restriction)	AI	-0.04%	-0.02%	0.03%	100%	99%
	RA	0.01%	0.11%	0.10%	100%	100%
P2 (Removal of interpolation)	AI	0.02%	0.07%	0.15%	100%	100%
	RA	0.01%	0.02%	0.13%	101%	100%
P3 (Restriction on WIP modes)	AI	0.03%	-0.02%	-0.03%	100%	101%
	RA	0.03%	0.04%	-0.01%	100%	100%
P4 (P1 + P2 + P3)	AI	-0.03%	-0.04%	0.01%	99%	99%
	RA	0.03%	0.12%	0.06%	100%	100%

❑ Simplifications of PDPC are proposed to reduce complexity without loss