



Bi-Intra Prediction using slope information

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Contents



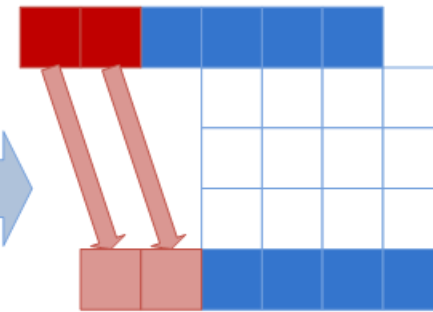
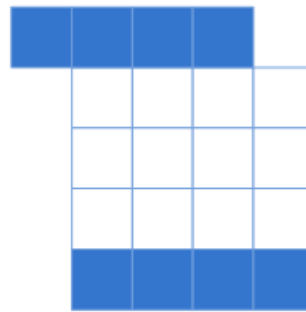
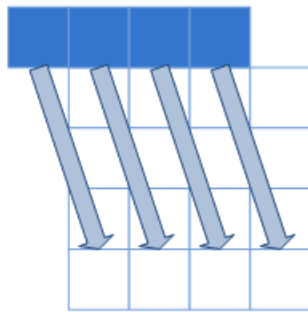
- **Bi-Intra Prediction (BIP)**
- **Simulation results**
- **Conclusions**

Bi-Intra Prediction (BIP) [1/4]

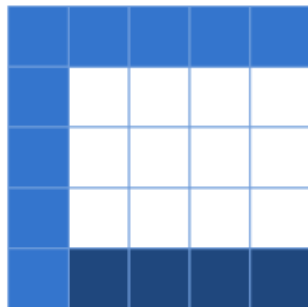
- Algorithm of Bi-Intra Prediction

Ex) 4x4 Vertical prediction with a negative direction

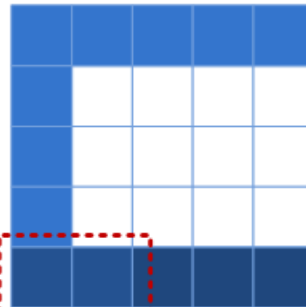
Mode # > 9 or DC mode → BIP is not used.



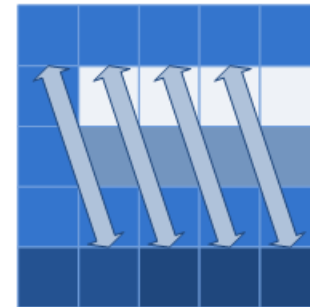
Compute an offset to predict the last line



Add the offset to the prediction values of the last line



Smoothing for the two reference pixels



Apply BIP

Bi-Intra Prediction (BIP) [2/4]

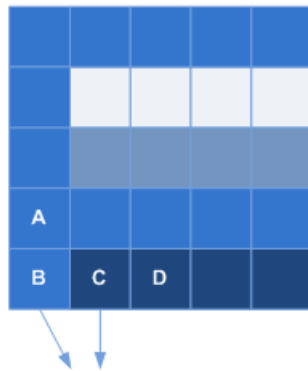


- The offset is unreliable when the absolute value of that is too large.
- Clipping for large offset
 - $\text{Offset} = \text{Clip}(-20 \ll B_{\text{Inc}}, 20 \ll B_{\text{Inc}}, \text{Offset})$
- Template size to calculate the offset
 - $\text{Block_size}/2$

Bi-Intra Prediction (BIP) [3/4]

- Reference pixel smoothing

Reference pixel smoothing



Smoothing filter

$$B' = (A + 2*B + C) / 4$$

$$C' = (B + 2*C + D) / 4$$

Performance of prediction would be degraded when the difference between B and C is large.

Bi-Intra Prediction (BIP) [4/4]



- **The flag for BIP is embedded within the quantized transform coefficients.**
 - Uni-intra prediction using UIP
 - Sum of absolute values of quantized coefficients is even. (0, 2, 4...)
 - Bi-intra prediction using offset and reference smoothing
 - Sum of absolute values of quantized coefficients is odd. (1, 3, 5...)
 - Uni- or bi-prediction is selected based on R-D optimization.

Simulations [1/2]



■ Simulation conditions

➤ Intra only

- Low complexity
- High Efficiency

➤ Test sequences

- Class A (2560x1600)
- Class B (1920x1080)
- Class C (832x480)
- Class D (416x240)
- Class E (1280x720)

➤ Test Conditions

- Common conditions defined by JCTVC-D600

➤ Anchor

- HM2.0

Simulations [2/2]

■ Summary

➤ Using 32 bits executable files

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.3	-0.5	-0.5	-0.6	-0.8	-0.8
Class B	-0.3	-0.6	-0.6	-0.7	-1.0	-0.9
Class C	-0.4	-0.9	-0.9	-0.6	-1.1	-1.0
Class D	-0.5	-1.0	-0.9	-0.8	-1.0	-1.1
Class E	-0.4	-1.0	-0.8	-0.7	-1.2	-1.2
All	-0.4	-0.8	-0.7	-0.7	-1.0	-1.0
Enc Time[%]	139%			122%		
Dec Time[%]	101%			104%		

➤ Using 64 bits executable files

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.3	-0.5	-0.5			
Class B	-0.3	-0.6	-0.6			
Class C	-0.4	-0.9	-0.9			
Class D	-0.5	-1.0	-0.9			
Class E	-0.4	-1.0	-0.8			
All	-0.4	-0.8	-0.7			
Enc Time[%]	155%					
Dec Time[%]	100%					

➤ The results were checked by Huawei and Sharp. (JCTVC-E290, JCTVC-E161).

Conclusions



- **BIP improves coding efficiency of intra prediction in HM.**

- **It is required to optimize the signaling method of BIP.**
 - It is highly related to entropy coding of transform coefficients.
 - There is not enough time to optimize the method.
 - The optimization will improve the coding efficiency and reduce the encoding complexities.

- **BIP can be combined with any directional intra prediction method.**
 - It is required to study more to investigate combinations with the other prediction methods.