

JCTVC-F253

# Simplified Bidirectional Intra Prediction

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# Summary

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- **Bidirectional Intra Prediction (BIP)**
  - Originally proposed at Marrakech VCEG meeting (VCEG-AE14)
  - Experimental results based on TE6 were reported (JCTVC-C079)
  - Improved BIP was proposed in CE6 (JCTVC-D108)
- **Proposal**
  - Simplified BIP to reduce the computational complexity
- **Related contributions**
  - JCTVC-F566 (CE6.c: DCIM+BiPred)
  - JCTVC-F438 (Cross-checked by I2R)
- **Results**
  - BD-rate, IO-LC: **0.3%**, IO-HE: **0.1%**
  - EncTime, IO-LC: **102%**, IO-HE: **103%**
  - DecTime, IO-LC: **101%**, IO-HE: **101%**

# Simplified Bidirectional Intra prediction (BIP)

- BIP principle

- Weighted average of two kinds of UIP modes

$$predBi[n] = (w[n] * predL0[n] + ((1 \ll shift) - w[n]) * predL1[n] + (1 \ll (shift - 1))) \gg (shift)$$

\*) Shift value is set to 10.

- Proposal (Simplified BIP)

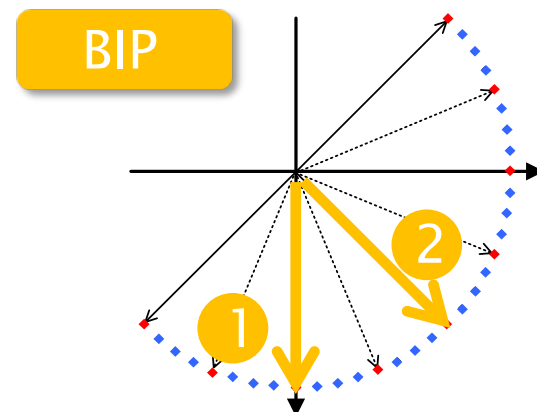
- Restricted UIP modes used for BIP modes

- UIP modes (0, 1, 2, 3, 6, 9)

- Just copy modes (reference pixel is copied simply)
- DC mode (reference pixel is averaged simply)

- Reduction of BIP modes

- BIP mode derived from top and left PU
- 8 BIP modes  $\rightarrow$  2 BIP modes



Select two prediction directions based on restricted UIP modes

# Complexity Analysis

- Operation counts of UIP for worst case

<b>HM3.0 UIP (Anchor)</b>	Mul (/pel)	Add (/pel)	Shift (/pel)
Derivation of position	0	$1+2/N$	$1/N$
Interpolation	2	3	1
Total	2	$4+2/N$	$1+1/N$
e.g. 4x4 block	2	4.5	1.25

→ For 4x4 block, Sum of operation counts is 7.75 (/pel)

- Operation counts of SBIP for worst case

<b>Simplified BiPred</b>	Mul (/pel)	Add (/pel)	Shift (/pel)
Derivation of position	0	1	0
Weighted averaging	2	3	1
Total	2	4	1
e.g. 4x4 block	2	4	1

→ For 4x4 block, Sum of operation counts is 7.00 (/pel)

# Experimental Results

## Simplified Bidirectional Intra Prediction (SBIP)

- HM Software version 3.0 based on HM common condition.
- Coding structure: I-Only (HE, LC)

	IO-HE			IO-LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2
Class B	-0.1	0.0	0.0	-0.2	-0.2	-0.2
Class C	-0.3	-0.2	-0.2	-0.5	-0.4	-0.4
Class D	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2
Class E	-0.1	0.0	0.0	-0.2	-0.2	-0.1
All	-0.1	-0.1	-0.1	-0.3	-0.2	-0.2
Enc Time[%]	103%			102%		
Dec Time[%]	101%			101%		

- BD-rate gain of BIP is **0.1%** (for HE), **0.3%** (for LC) on average without significant Enc/Dec time increase.

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