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Removal of Duplicated Combinations of Reference Picture Indices for Forward Bi-Prediction

Tzu-Der Chuang, Jian-Liang Lin, Yu-Wen Huang, Shawmin Lei

Presented by Shawmin Lei

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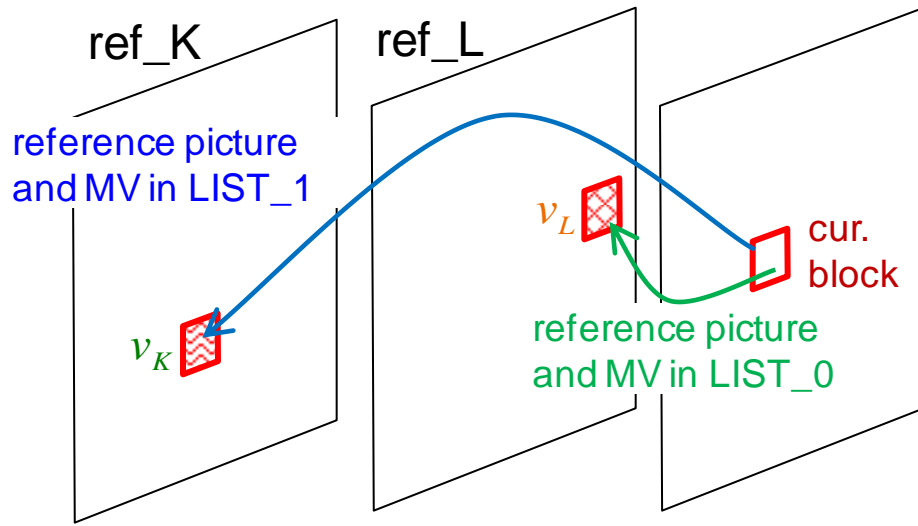
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Overall Summary

- Remove duplicated combinations of reference picture indices for forward bi-prediction (e.g., Low-Delay configurations)

  - Reduce encoding time by skipping ME search for duplicated reference picture combinations
  - Code words are modified to reflect duplication removal

- Experimental Results: Anchor D600, Low-Delay settings

  - Encoding Time: Reduce 19% for HE-LC and 26% for LC-LD
  - BD-rate: Increase 0.6% for HE-LC and 0.4% for LC-LD
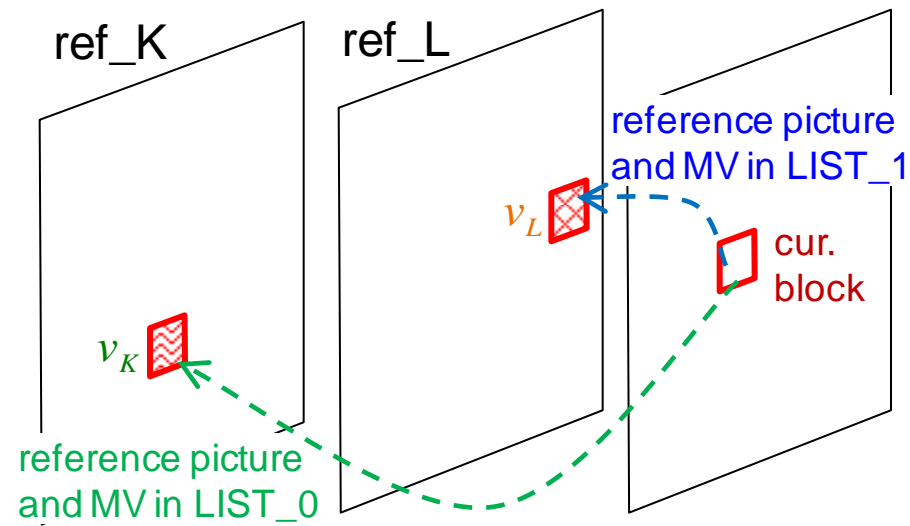
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Duplicated Reference Picture Combinations in Forward Bi-prediction

- The reference picture list 0 (LIST_0) and the reference picture list 1 (LIST_1) are identical in forward B-pictures

- The same motion compensation (MC) result for A and B
  – The reference index (refIdx) combination of A and B are equivalent
  – One of them is redundant

A

ref_K   ref_L

reference picture and MV in LIST_1

v_L

cur. block

reference picture and MV in LIST_0

v_K

B

ref_K   ref_L

reference picture and MV in LIST_1

v_L

cur. block

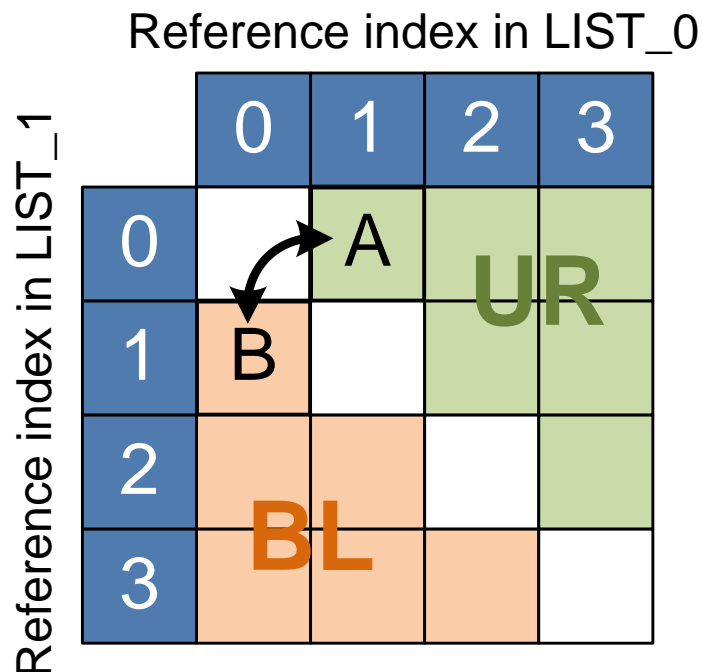reference picture and MV in LIST_0

v_K

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Combination of refIdx in Bi-prediction

- Each list in a forward B-picture has four reference pictures in test condition JCTVC-D600

- The refIdx combinations in upper-right triangle are equivalent to that in bottom-left triangle

Reference index in LIST_0

	0	1	2	3
0		A	UR	UR
1	B			UR
2	BL			UR
3	BL	BL	BL	

Reference index in LIST_1

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Proposed Reduction of Reference Picture Indices Combinations

- Skip the ME search for the BL-triangle of refIdx combinations in bi-prediction to save encoding time

Reference index in LIST_0

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CABAC Code Word Modification

- Re-design LIST_1 refIdx code words to avoid syntax redundancy
  - Less refIdx combinations are required to be coded
  - The refIdx range of LIST_1 is limited when refIdx of LIST_0 is determined

refIdx of List_0

refIdx of List_1	0	1	2	3
0	0	0	0	0
1	10	10	10	10
2	110	110	110	110
3	111	111	111	111

Original code word of List_1

refIdx of List_0

refIdx of List_1	0	1	2	3
0	-	0	0	0
1		1	10	10
2			11	110
3				111

Modified code word of List_1

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Simulation Results

- JCTVC-D600 anchor

- The results were cross-checked by Qualcomm (E443)

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class B	0.7	0.9	0.8	0.6	0.9	1.1
Class C	0.6	0.6	0.7	0.3	0.4	0.2
Class D	0.5	0.5	0.3	0.4	0.3	0.3
Class E	0.6	0.6	1.0	0.4	0.6	0.3
All	**0.6**	**0.7**	**0.7**	**0.4**	**0.5**	**0.5**
Enc Time[%]	**81%**			**74%**		
Dec Time[%]	103%			100%		

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Thank You.

Encoder Issue Result

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class B	0.7	0.9	0.7	0.8	0.9	1.3
Class C	0.6	0.6	0.6	0.5	0.6	0.3
Class D	0.6	0.6	0.6	0.6	0.8	0.8
Class E	0.9	0.7	1.2	0.7	0.6	0.8
All	0.7	0.7	0.7	0.6	0.7	0.8
Enc Time[%]	81%			74%		
Dec Time[%]	101%			100%		

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