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CE9: Results of Experiment ROB04

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Overall Summary

- To achieve parsing robustness
  - Parsing errors not caused by any data loss of a reference picture

- Basic approach
  - Avoid removing redundant MVPs
  - Force the availability of the TMVP as long as it is inside the picture

- Proposed approaches
  - Tool 1: replacing redundant MVPs
  - Tool 2: motion ID
    - Reducing redundant MVPs without comparing MV values but motion IDs

- Results of ROB04 (tool 1 + tool 2)
  - 0.3-0.5% bit rate increases

- Results of ROB02 (JCTVC-F474) + Tool 2 (motion ID)
  - 0.1-0.2% bit rate increases

Outline

- Problem definition

- Parsing robustness solutions

- Experimental results

- Conclusions

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Problem Definition

- Due to the usage of temporal MVPs and removal of redundant MVPs, when an MV in a previous picture cannot be decoded correctly, a mismatch between the candidate set on the encoder side and that on the decoder side occurs, which may result in a parsing error of an MVP index.

- The rest of the current picture and following pictures can not be parsed correctly.

- One small decoding error of an MV causes parsing error propagation of many subsequent pictures.

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Basic Approach

- To avoid removing redundant MVPs
    - In the AMVP scheme, xUniqueMVPCand is bypassed.
    - In the Merge scheme, removing redundancy and avoiding imitation are bypassed.

- The spatial MVP always exists unless:
    - Neighboring PU is outside the picture.
    - Neighboring PU is coded in Intra.

- The temporal MVP always exists unless:
    - TMVP position is outside the picture.
    - The co-located picture is coded as I-slice.
        - The slice type of the co-located picture may be lost.
        - One flag in the slice header to indicate the usage of TMVPs

- Two proposed tools will be added on top of this basic approach.

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Tool 1 - Replacing Redundant MVPs (1/3)

- For temporal MVPs in the AMVP and Merge schemes

- If the temporal MVP derived from H is redundant, the substitutes are T_c, T_o, F, G, and zero MV in order.

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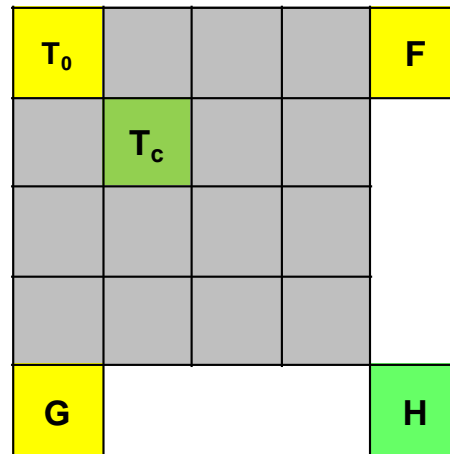
Tool 1 - Replacing Redundant MVPs (2/3)

- For spatial MVPs in the AMVP scheme

- The top MVP exists when the MVs can be derived by
  - B_0' MV with the same list and the same ref. picture
  - or B_1' MV with the same list and the same ref. picture

- If the top MVP exists and all the above possible MVPs are identical to the left MVP, the substitute is searched based on the following order
  - B_2' MV with the same list and the same ref. picture
  - B_0' MV with different list or/and different ref. picture
  - B_1' MV with different list or/and different ref. picture
  - B_2' MV with different list or/and different ref. picture

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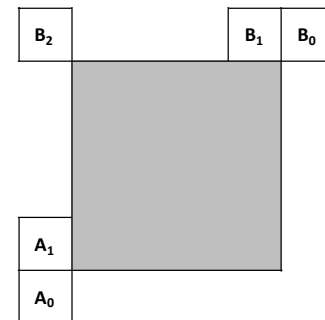
Tool 1 - Replacing Redundant MVPs (3/3)

- For spatial MVPs in the Merge scheme

- Replace redundant spatial MVPs by zero MV

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Tool 2 – Motion ID

- A unique motion identification (ID) is assigned for each Inter PU and conditionally assigned for a Skip/Merge PU that selects a temporal MVP

- Motion IDs can be inherited through the Skip/Merge modes

- For a current PU, an MVP with the same motion ID as another MVP can be removed.

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Removing Redundancy by Motion IDs

- Assume green PUs have the same motion ID

- For the current PU, candidate A and candidate C are redundant due to the same motion ID.

- Candidate C is removed.

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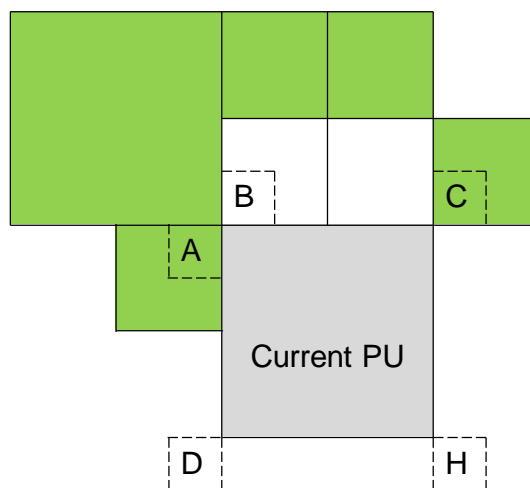
Deriving Motion IDs

- A unique motion ID is assigned for each Inter PU

- For a Skip/Merge PU that selects a spatial MVP, the motion ID is inherited from the selected MVP.

- For a Skip/Merge PU that selects a temporal MVP, the motion ID is dependent on its neighboring PUs
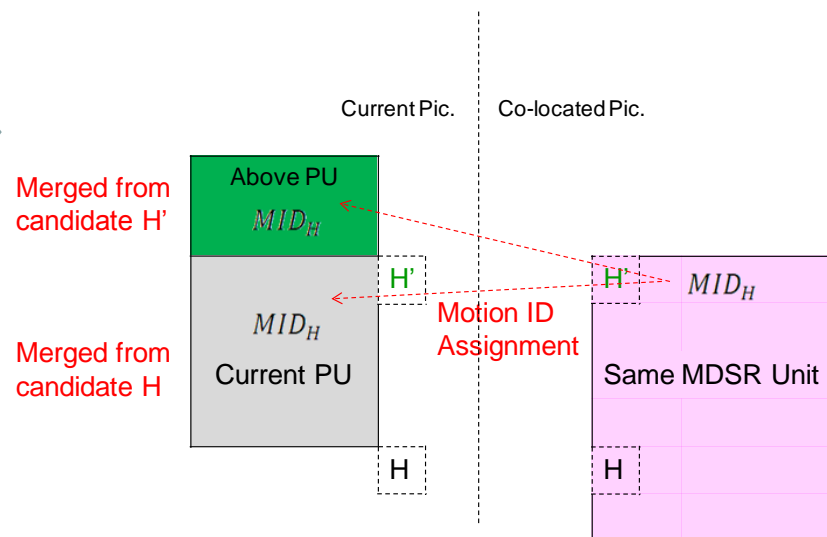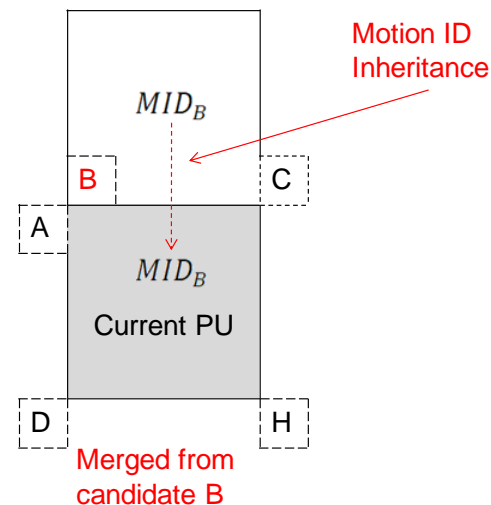
Experiments

- Anchor: HM-3.0 with a fix of bug #146

- Experiment 1: disabling temporal MVPs for all pictures

- Experiment 2: basic approach for parsing robustness

- Experiment 3: proposed tool 1

- Experiment 4: proposed tool 2

- Experiment 5: combining tool 1 and tool 2

- We thank Canon for crosscheck (JCTVC-F476)

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Results of Experiment 1

- TMVPs not allowed in all pictures

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	3.1	2.6	2.8	3.3	2.8	2.8
Class B	2.0	1.4	1.4	1.7	1.1	1.1
Class C	2.1	2.1	2.2	2.0	2.0	2.1
Class D	2.1	2.0	2.0	2.0	1.8	1.8
Class E						
Overall	**2.3**	**2.0**	**2.0**	**2.2**	**1.9**	**1.9**
Enc Time[%]	92%			93%		
Dec Time[%]	97%			96%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	2.1	1.8	1.2	2.3	1.6	1.5
Class C	2.5	2.6	2.7	2.6	2.4	2.4
Class D	2.2	1.8	2.1	2.2	1.2	1.3
Class E	2.9	2.7	2.1	2.6	1.4	2.0
Overall	**2.4**	**2.2**	**2.0**	**2.4**	**1.7**	**1.8**
Enc Time[%]	93%			93%		
Dec Time[%]	98%			94%		

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Results of Experiment 2

- Basic approach
  - To avoid removing redundant MVPs
  - To force the availability of the temporal MVP

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	1.0	0.9	1.0	1.2	1.0	1.0
Class B	1.3	0.8	0.8	1.4	1.0	0.9
Class C	1.4	1.3	1.3	1.4	1.3	1.4
Class D	1.3	1.1	1.1	1.3	0.9	1.1
Class E						
Overall	**1.3**	**1.0**	**1.0**	**1.3**	**1.0**	**1.1**
Enc Time[%]	108%			107%		
Dec Time[%]	100%			97%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	1.6	1.2	0.7	1.7	1.2	1.2
Class C	1.5	1.3	1.2	1.4	1.0	1.2
Class D	1.5	1.0	1.6	1.4	1.0	0.9
Class E	3.6	3.4	2.7	4.1	2.9	3.5
Overall	**1.9**	**1.6**	**1.4**	**2.0**	**1.4**	**1.6**
Enc Time[%]	107%			106%		
Dec Time[%]	98%			99%		

Results of Experiment 3

- Proposed tool 1: to replace redundant MVPs

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.7	0.9	1.1	0.7	0.8	0.8
Class B	0.9	0.6	0.5	0.9	0.7	0.7
Class C	1.0	1.0	1.0	1.0	0.9	1.0
Class D	0.9	0.8	0.9	0.8	0.6	0.8
Class E						
Overall	**0.9**	**0.8**	**0.8**	**0.9**	**0.8**	**0.8**
Enc Time[%]	109%			108%		
Dec Time[%]	98%			97%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	1.1	0.6	0.4	1.0	0.6	0.7
Class C	1.0	0.6	0.7	0.8	0.6	0.5
Class D	1.0	0.8	0.9	0.9	0.5	0.5
Class E	3.0	2.8	3.1	3.0	2.4	3.2
Overall	**1.4**	**1.1**	**1.1**	**1.3**	**0.9**	**1.1**
Enc Time[%]	108%			107%		
Dec Time[%]	99%			105%		

Results of Experiment 4

- Proposed tool 2: motion ID

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.6	0.9	0.8	0.7	0.8	0.8
Class B	0.5	0.3	0.3	0.6	0.5	0.5
Class C	0.6	0.6	0.7	0.9	0.9	1.1
Class D	0.5	0.5	0.5	0.6	0.5	0.6
Class E						
Overall	**0.5**	**0.6**	**0.6**	**0.7**	**0.7**	**0.7**
Enc Time[%]	101%			102%		
Dec Time[%]	100%			102%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.5	0.3	0.1	0.7	0.4	0.1
Class C	0.6	0.5	0.5	0.7	0.7	0.5
Class D	0.4	0.0	0.4	0.6	0.2	0.0
Class E	1.3	1.2	0.4	1.8	1.1	1.6
Overall	**0.6**	**0.5**	**0.3**	**0.9**	**0.5**	**0.5**
Enc Time[%]	102%			104%		
Dec Time[%]	100%			101%		

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Results of Experiment 5

- To combine tool 1 and tool 2

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.3	0.6	0.6	0.4	0.6	0.6
Class B	0.2	0.2	0.2	0.3	0.3	0.3
Class C	0.4	0.4	0.6	0.6	0.7	0.7
Class D	0.4	0.4	0.3	0.4	0.4	0.3
Class E						
Overall	**0.3**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**
Enc Time[%]	102%			102%		
Dec Time[%]	101%			102%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.2	-0.1	-0.2	0.3	0.1	0.1
Class C	0.3	0.1	0.1	0.4	0.4	0.3
Class D	0.2	-0.1	0.8	0.3	0.3	-0.2
Class E	0.8	1.0	-0.2	1.3	1.2	1.2
Overall	**0.3**	**0.2**	**0.1**	**0.5**	**0.4**	**0.3**
Enc Time[%]	103%			104%		
Dec Time[%]	102%			102%		

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Combination of ROB02 and Motion ID

- ROB02 proposed by Canon in JCTVC-F474 is in the same category of the proposed tool 1.

	HE-RA			LC-RA		
	Y	U	V	Y	U	V
Class A	0.1	0.1	0.0	0.1	0.2	-0.1
Class B	0.1	0.2	0.1	0.0	0.1	0.1
Class C	0.2	0.3	0.3	0.3	0.2	0.3
Class D	0.2	0.1	0.2	0.2	0.1	0.1
Class E						
Overall	**0.2**	**0.1**	**0.2**	**0.1**	**0.1**	**0.1**
Enc Time[%]	102%			103%		
Dec Time[%]	96%			97%		

	HE-LD			LC-LD		
	Y	U	V	Y	U	V
Class A						
Class B	0.0	-0.1	-0.3	-0.3	-0.2	0.1
Class C	0.1	0.2	0.0	0.1	0.0	0.0
Class D	0.1	-0.4	0.5	0.1	0.1	-0.1
Class E	0.5	1.0	0.6	0.8	0.8	1.0
Overall	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**
Enc Time[%]	103%			104%		
Dec Time[%]	96%			97%		

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Conclusions

- Proposed two tools to achieve parsing robustness

- Tool 1: replacing redundant MVPs

- Tool 2: reducing redundant MVPs by motion IDs

- Combining tool 1 and tool 2
  - 0.3-0.5% bit rate increases

- Combining ROB02 and tool 2
  - 0.1-0.2% bit rate increases

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