

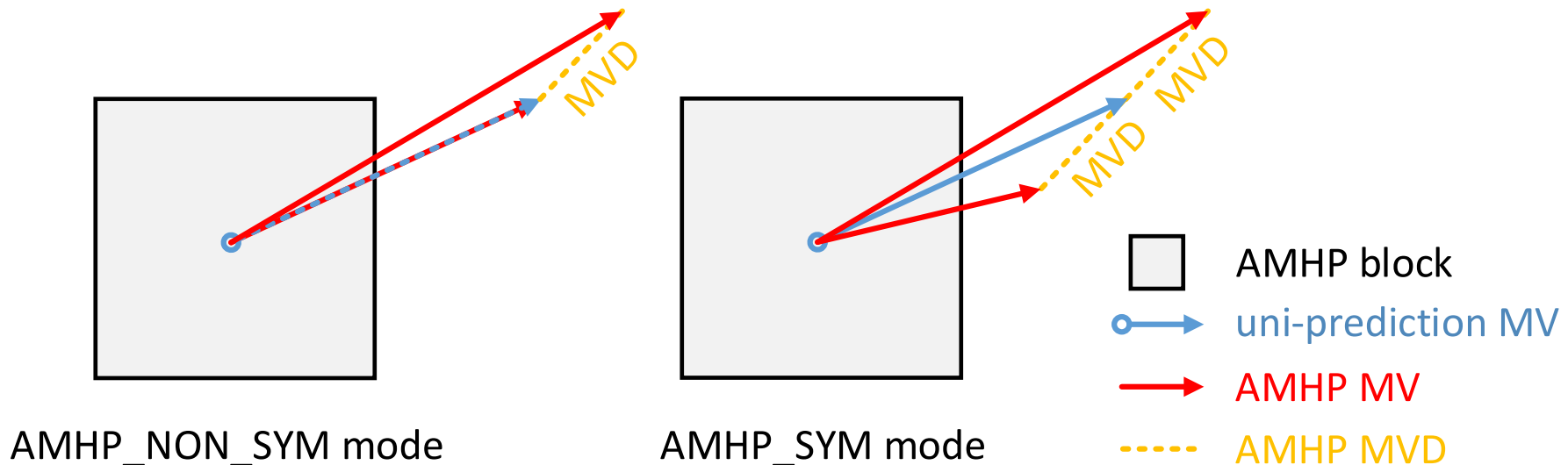


Non-CE4: Advanced Multi-hypothesis Inter Prediction

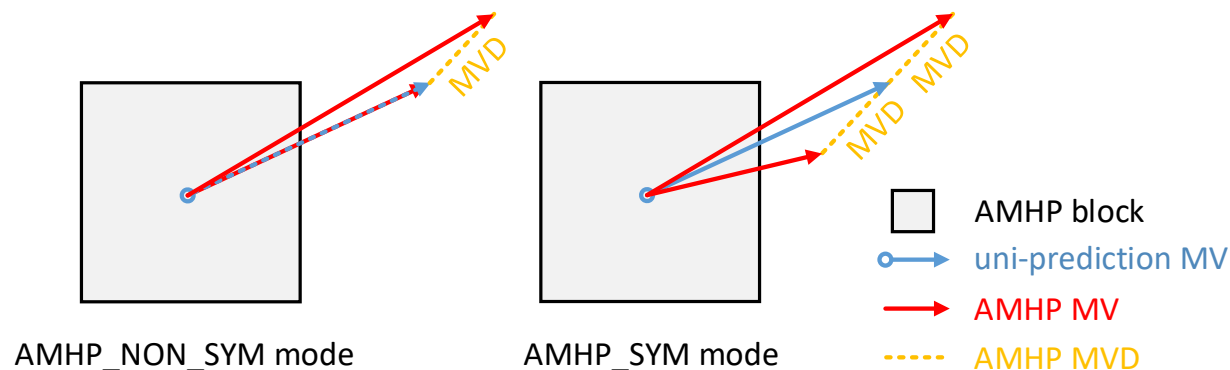
Yucheng Sun
2019/3/18

- Proposed method
- Bandwidth analysis
- Experimental Results
- Conclusion

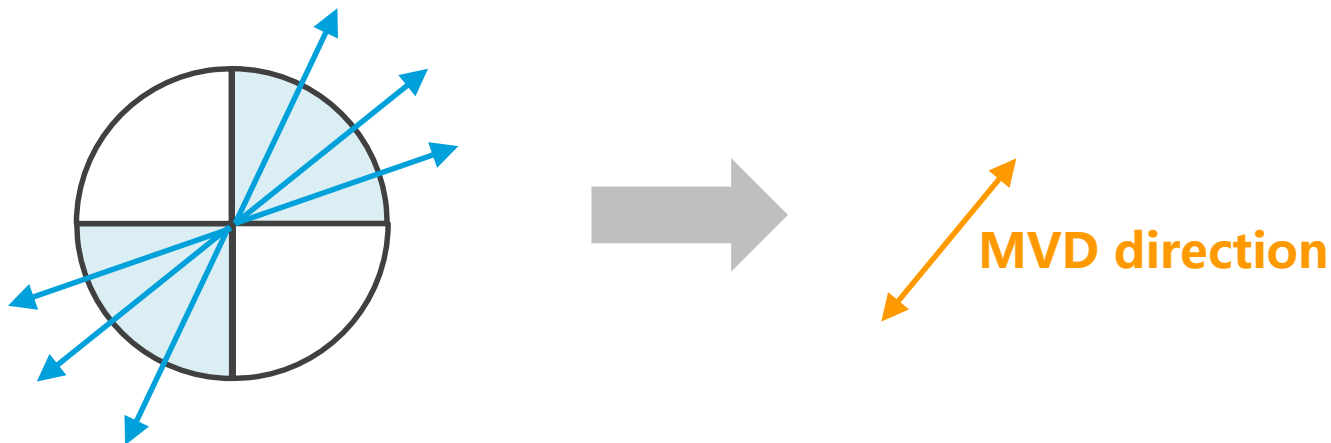
- Advance multi-hypothesis inter prediction (AMHP)
 - For **uni-prediction** of AMVP mode
 - Only **one extra MV** refer to the same reference frame
 - Two modes
 - Non-symmetric mode
 - symmetric mode



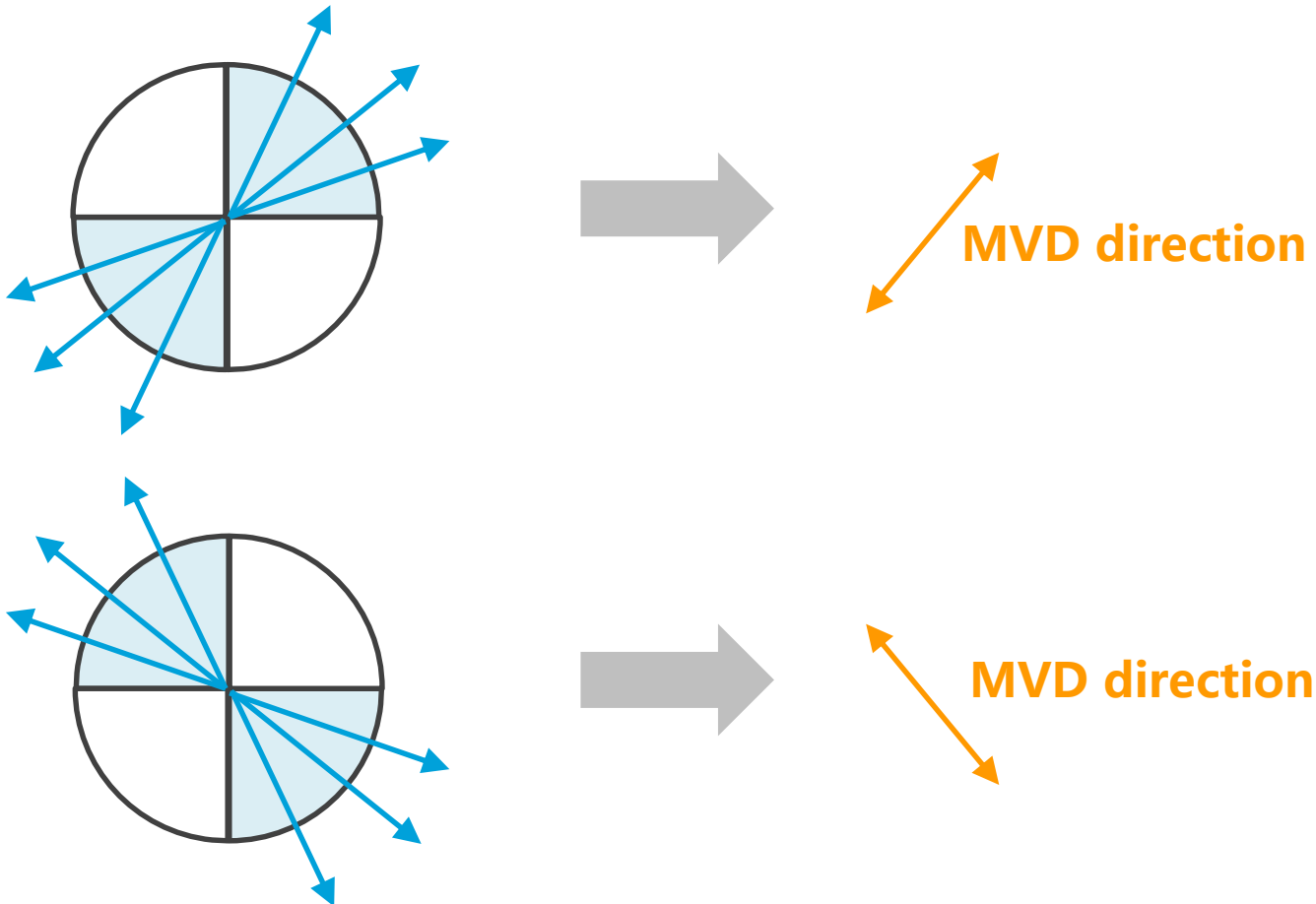
- Advance multi-hypothesis inter prediction (AMHP)



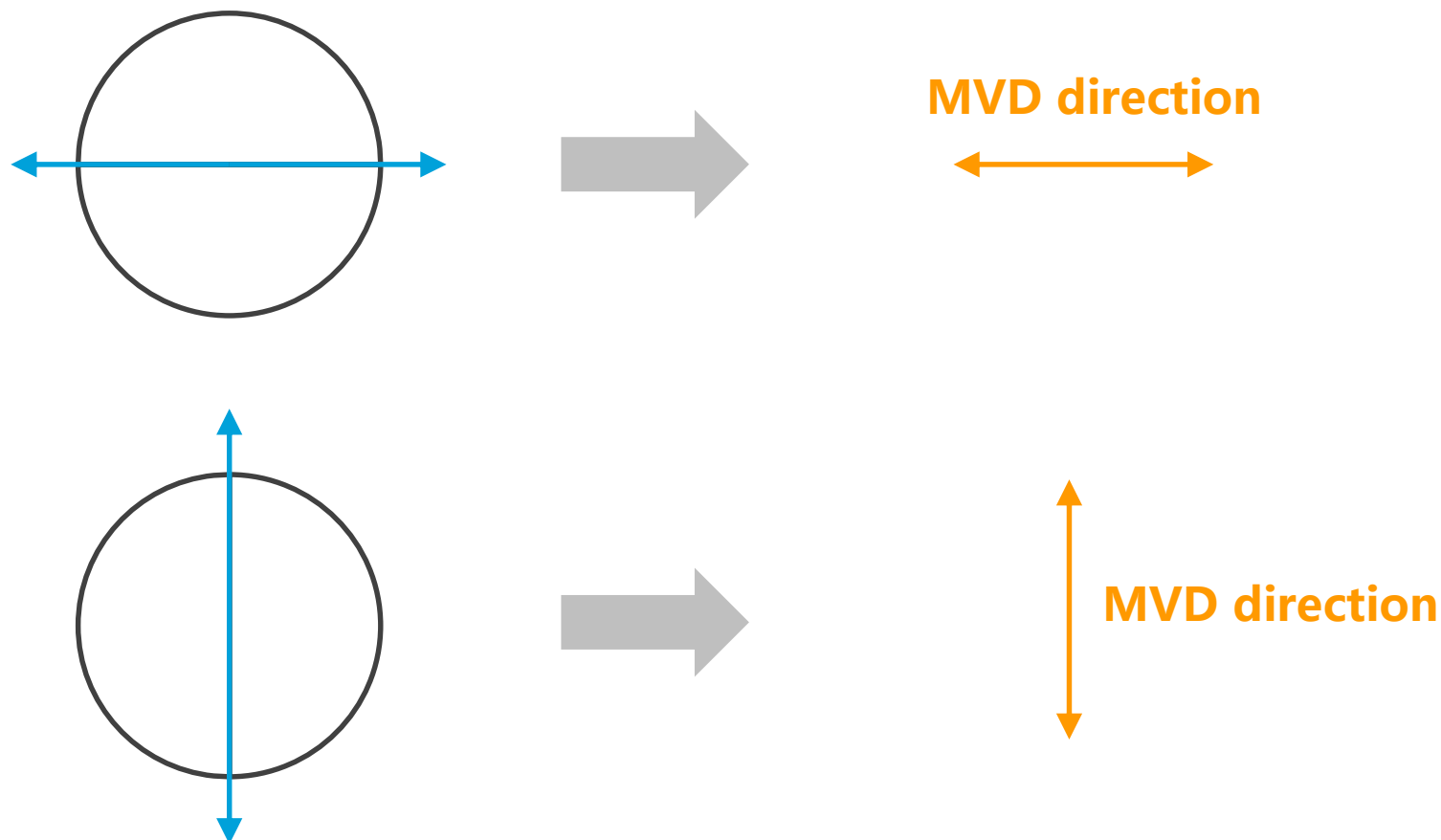
- MVD direction is determined by uni-prediction MV's direction



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 - MVD direction is determined by uni-prediction MV's direction

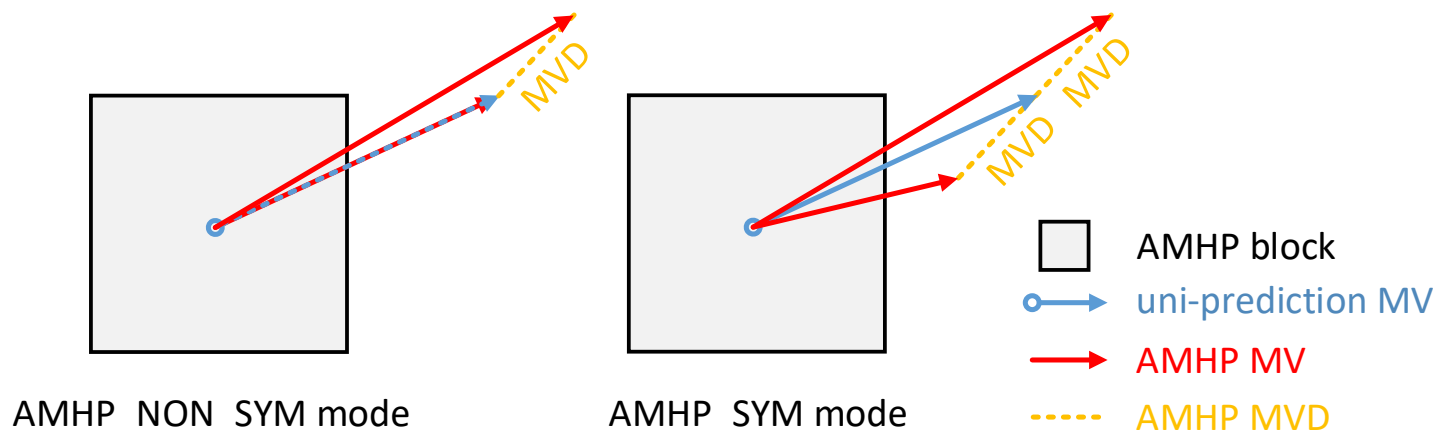


- Advance multi-hypothesis inter prediction (AMHP)
 - MVD direction is determined by uni-prediction MV's direction



- Advance multi-hypothesis inter prediction (AMHP)
 - MVD direction is determined by uni-prediction MV's direction
 - MVD value is determined by amhp_idx

amhp_idx	0	1	2	3	4	5
AMHP mode	Non-sym mode				Sym mode	
MVD value	1/4-pel	1/16-pel	1/4-pel	1/16-pel	1/4-pel	1/2-pel



- Be referenced by other mode
 - AMVP mode:
 - Regard AMHP as a **uni-prediction** block
 - Use **average MV** for MVP list construction
 - Other mode(Merge, HMVP, MMVD):
 - Regard AMHP as a **bi-prediction** block
 - Use two AMHP MV for candidate list construction

- Advance multi-hypothesis inter prediction (AMHP)
 - In **P frame**
 - AMHP get the prediction block from the same reference
 - AMHP won't increase the bandwidth.

block size		bandwidth		
width	height	uni-prediction	bi-prediction	AMHP
4	4	7.56	-	Disabled
4	8	5.16	-	Disabled
8	4	5.16	-	Disabled
8	8	3.52	-	4
4	16	3.95	-	4.5
16	4	3.95	-	4.5

- Advance multi-hypothesis inter prediction (AMHP)
 - In **B frame**
 - AMHP is disabled when the reference frame exist in both list
 - E.g. list0{ 0, **8** } list1 { **8**, 16 }, AMHP is disabled when uni-prediction MV referring to frame 8.
 - AMHP get the prediction block from the same reference
 - AMHP won't increase the bandwidth

block size		bandwidth		
width	height	uni-prediction	bi-prediction	AMHP
4	4	7.56	-	9
4	8	5.16	10.31	6
8	4	5.16	10.31	6
8	8	3.52	7.03	4
4	16	3.95	7.91	4.5
16	4	3.95	7.91	4.5

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.06%	0.01%	101%	101%
Class A2	-0.03%	-0.02%	-0.01%	101%	99%
Class B	-0.04%	-0.02%	-0.04%	101%	101%
Class C	-0.03%	-0.02%	-0.18%	101%	104%
Class E					
Overall	-0.03%	-0.00%	-0.06%	101%	101%
Class D	0.00%	-0.09%	0.00%	102%	104%
Class F	-0.04%	-0.01%	-0.14%	102%	104%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	-0.15%	-0.20%	101%	101%
Class C	-0.05%	0.21%	0.14%	101%	102%
Class E	-0.04%	0.32%	-0.37%	101%	104%
Overall	-0.02%	0.09%	-0.13%	101%	102%
Class D	0.01%	0.63%	-0.42%	101%	102%
Class F	-0.17%	-0.07%	-0.54%	101%	102%

	Low delay P Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.95%	-1.29%	-1.30%	102%	103%
Class C	-0.66%	-0.96%	-1.00%	102%	99%
Class E	-0.83%	-1.02%	-0.96%	102%	99%
Overall	-0.82%	-1.11%	-1.12%	102%	100%
Class D	-0.49%	-0.47%	-0.47%	99%	101%
Class F	-0.43%	0.09%	-0.15%	101%	102%

Thank HHI for the cross-checking

- AMHP is a multi-hypothesis prediction for uni-prediction of AMVP mode.
 - Same reference
 - MV difference no more than 1 pixel
- AMHP won't increase bandwidth cost
 - For P frame : AMHP is enabled when
 - $(\text{block_width} + \text{block_height}) > 12$
 - For B frame : AMHP is enabled in all block size
- Experimental results reportedly show
 - -0.03% -0.00% -0.06% Enc 101% Dec 101% compared to VTM-RA
 - -0.02% 0.09% -0.13% Enc 101% Dec 102% compared to VTM-LDB
 - -0.82% -1.11% -1.12% Enc 102% Dec 100% compared to VTM-LDB
- Based on the above results, it is suggested to further study it in CE

THANKS !

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