

# Bottom-up Checking and Rate-distortion Ratio based Fast InterIMV Mode in Versatile Video Coding

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## Background

### Versatile Video Coding (VVC)

Latest video compression standard with wider scope of applications

requires

More complex structure  
New compression tools

16 times slower than HEVC

Speed up for VVC if necessary

## Problem

### InterIMV mode:

Most time-consuming new tool

Redundancy exist in:

- ① Unnecessary depths
- ② Unsuitable CUs
- ③ Unimportant frames

## Solution

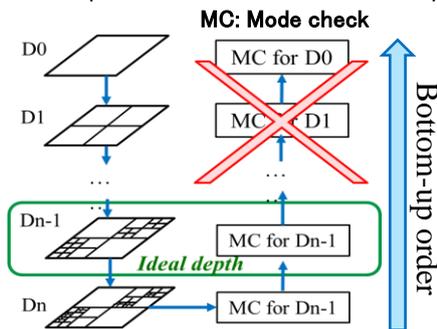
Speed up by removing redundant checks in different levels

- Proposal 1: Bottom-up check in depth level
- Proposal 2: RD-ratio based check skip on Cu level
- Proposal 3: Skip range adjustment on frame level

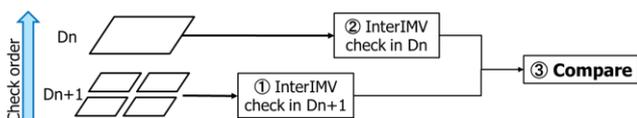
## Proposals

### P1. Bottom-up InterIMV mode check in depth level

Check InterIMV mode in bottom-up order after whole depth to avoid mis-check of depth



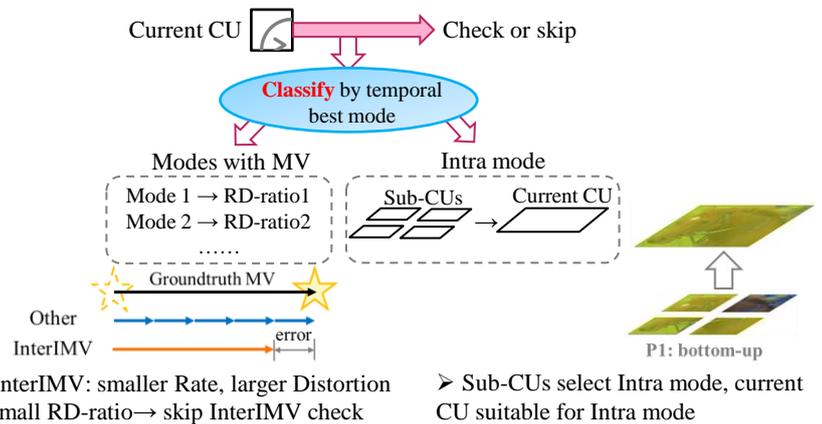
Find ideal depth



Dn better: ideal depth not found → check Dn-1 and compare

Dn+1 better: Dn+1 ideal depth → skip check from Dn-1 to D0

### P2: RD-ratio based redundancy removal and temporal best mode based CU classification on CU level

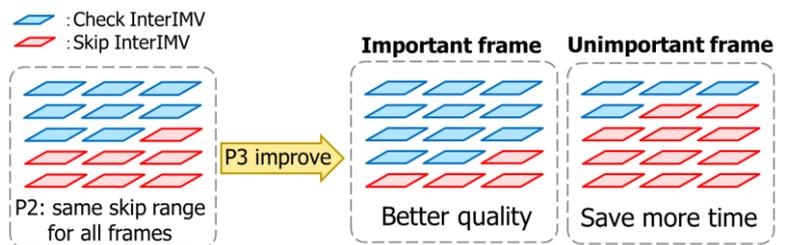


InterIMV: smaller Rate, larger Distortion

Small RD-ratio → skip InterIMV check

Sub-CUs select Intra mode, current CU suitable for Intra mode

### P3: Frame important based skip range adjustment

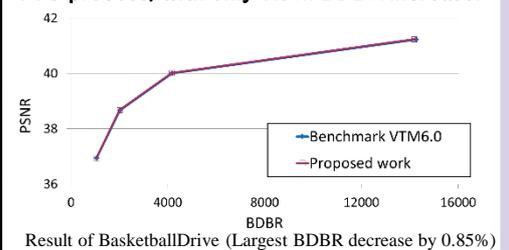


## Experiment result

Sequence	Remove all InterIMV		P1		P1+P2		P1+P2+P3	
	BDBR(%)	TS(%)	BDBR(%)	TS(%)	BDBR(%)	TS(%)	BDBR(%)	TS(%)
Campfire	0.82	15.56	0.02	6.29	0.30	15.02	0.25	12.54
CatRobot	1.07	12.92	0.35	4.99	0.74	10.31	0.47	9.36
DaylightRoad2	1.59	15.48	0.51	6.41	1.06	11.66	0.65	10.31
Cactus	0.93	11.97	0.33	3.68	0.48	9.20	0.45	8.31
BQTerrace	0.49	10.00	0.17	3.21	0.20	6.95	0.25	7.30
BasketballDrive	1.96	15.26	0.48	5.65	0.98	8.70	0.85	10.63
FourPeople	0.32	12.26	0.08	6.85	0.17	9.43	0.04	9.33
Johnny	0.28	12.83	0.04	4.77	0.23	8.90	0.03	9.00
PartyScence	0.46	11.38	0.12	4.77	0.16	8.47	0.16	9.70
BQMall	0.77	12.38	0.19	4.95	0.24	9.17	0.20	9.02
RaceHorses	0.69	16.27	0.05	5.73	0.22	9.62	0.32	9.43
BQSquare	0.02	8.47	0.01	2.82	0.04	5.58	0.00	7.67
Average	0.78	12.90	0.20	5.01	0.40	9.42	0.31	9.38

## Conclusion

Proposed methods speed up InterIMV mode check process for 73.71% ( 9.38% speed up in VVC process) with only 0.31% BDBR increase.



Result of BasketballDrive (Largest BDBR decrease by 0.85%)

73.71% speed up in InterIMV process

