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Further encoder improvement for intra mode decision

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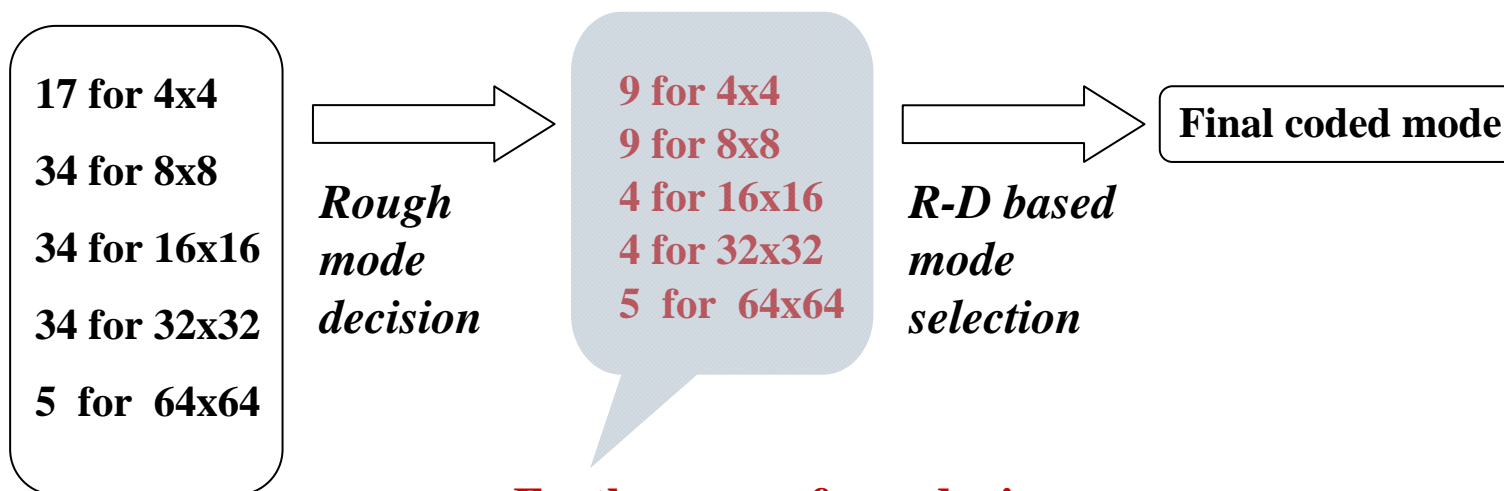
Outline

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Motivation

- In current HM, with the PU size of 4x4, 8x8, 16x16, 32x32 and 64x64, there are 9, 9, 4, 4 and 5 prediction modes for RD optimization



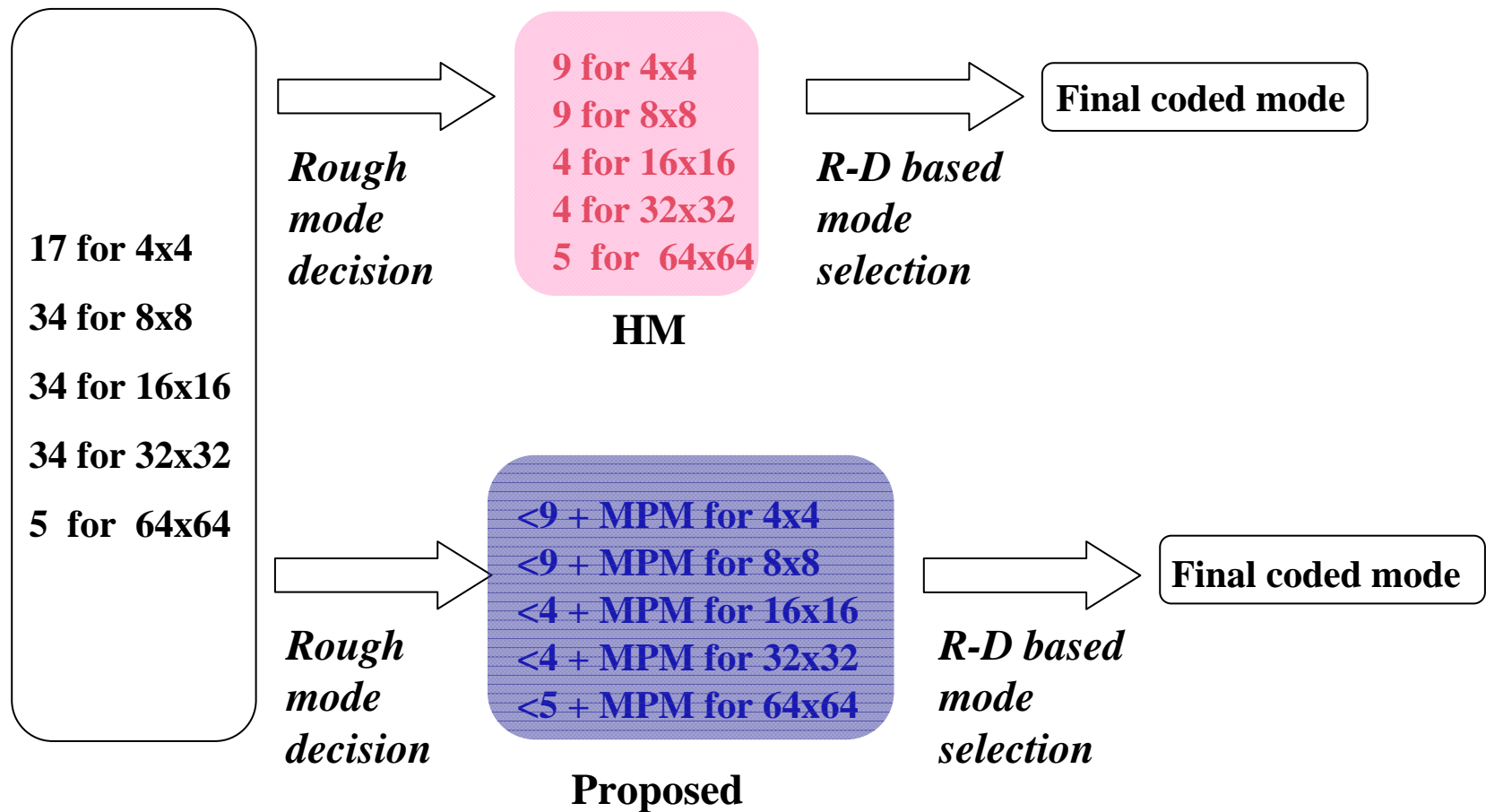
**Further room for reducing
the number of modes for
RD optimization**

Observation

- ❑ From our simulations, it is observed that about 80% of R-D optimized modes are from the first two modes in rough mode selection
- ❑ The hit ratio of the first two modes being R-D optimized mode varies for different PU sizes
- ❑ The most probable mode (MPM) covers a big ratio to be the R-D optimized mode



Proposed Method



Proposed Method

Default in HM	Proposed
N best RMD modes for RDO $N = \begin{cases} 9, & 4 \times 4, 8 \times 8 \\ 4, & 16 \times 16, 32 \times 32 \\ 5, & 64 \times 64 \end{cases}$	if MPM included in N best RMD modes N best RMD modes for RDO else N best RMD modes + MPM for RDO

Proposed Method

Settings for simulations	Number of N
S1	$N = \begin{cases} 3, & 4 \times 4, 8 \times 8 \\ 2, & 16 \times 16, 32 \times 32 \\ 1, & 64 \times 64 \end{cases}$
S2	$N = \begin{cases} 4, & 4 \times 4, 8 \times 8 \\ 2, & 16 \times 16, 32 \times 32 \\ 1, & 64 \times 64 \end{cases}$
S3	$N = \begin{cases} 5, & 4 \times 4, 8 \times 8 \\ 2, & 16 \times 16, 32 \times 32 \\ 1, & 64 \times 64 \end{cases}$
S4	$N = \begin{cases} 6, & 4 \times 4, 8 \times 8 \\ 2, & 16 \times 16, 32 \times 32 \\ 1, & 64 \times 64 \end{cases}$
S5	$N = \begin{cases} 8, & 4 \times 4, 8 \times 8 \\ 3, & 16 \times 16, 32 \times 32 \\ 3, & 64 \times 64 \end{cases}$



Simulation Results

□ BD rate and encoder running time using S1

	Intra HE			Intra LoCo		
	Y	U	V	Y	U	V
Class A	0.15	-0.25	-0.22	0.27	-0.41	-0.43
Class B	0.00	-0.44	-0.42	0.15	-0.61	-0.63
Class C	0.18	-0.47	-0.49	0.42	-0.48	-0.48
Class D	0.26	-0.47	-0.49	0.49	-0.43	-0.46
Class E	0.04	-0.19	-0.28	0.24	-0.41	-0.40
All	0.12	-0.39	-0.40	0.31	-0.49	-0.50
Enc Time[%]	80%			72%		

Simulation Results

□ BD rate and encoder running time using S2

	Intra HE			Intra LoCo		
	Y	U	V	Y	U	V
Class A	0.06	-0.23	-0.16	0.13	-0.30	-0.33
Class B	-0.04	-0.37	-0.36	0.01	-0.47	-0.46
Class C	0.08	-0.36	-0.38	0.24	-0.32	-0.32
Class D	0.14	-0.38	-0.39	0.29	-0.32	-0.30
Class E	-0.02	-0.18	-0.27	0.12	-0.26	-0.30
All	0.04	-0.32	-0.33	0.16	-0.35	-0.35
Enc Time[%]	83%			76%		

Simulation Results

□ BD rate and encoder running time using S3

	Intra HE			Intra LoCo		
	Y	U	V	Y	U	V
Class A	0.01	-0.17	-0.19	0.03	-0.24	-0.26
Class B	-0.07	-0.33	-0.30	-0.08	-0.36	-0.36
Class C	0.03	-0.27	-0.28	0.13	-0.24	-0.23
Class D	0.07	-0.22	-0.27	0.18	-0.24	-0.23
Class E	-0.05	-0.12	-0.21	0.05	-0.20	-0.22
All	-0.00	-0.24	-0.26	0.06	-0.27	-0.27
Enc Time[%]	86%			80%		



Simulation Results

□ BD rate and encoder running time using S4

	Intra HE			Intra LoCo		
	Y	U	V	Y	U	V
Class A	-0.02	-0.17	-0.14	-0.03	-0.19	-0.20
Class B	-0.09	-0.29	-0.27	-0.15	-0.29	-0.28
Class C	0.00	-0.21	-0.21	0.04	-0.16	-0.14
Class D	0.04	-0.18	-0.21	0.08	-0.18	-0.14
Class E	-0.06	-0.11	-0.23	-0.01	-0.14	-0.17
All	-0.03	-0.20	-0.22	-0.02	-0.20	-0.19
Enc Time[%]	88%			84%		

Simulation Results

□ BD rate and encoder running time using S5

	Intra HE			Intra LoCo		
	Y	U	V	Y	U	V
Class A	-0.12	-0.17	-0.19	-0.28	-0.22	-0.23
Class B	-0.19	-0.26	-0.27	-0.37	-0.27	-0.27
Class C	-0.07	-0.12	-0.13	-0.10	-0.11	-0.12
Class D	-0.05	-0.10	-0.14	-0.07	-0.09	-0.11
Class E	-0.20	-0.16	-0.26	-0.26	-0.24	-0.23
All	-0.13	-0.17	-0.20	-0.21	-0.18	-0.19
Enc Time[%]	97%			94%		

Conclusion

- ❑ Based on the proposed 5 solutions of the new encoding scheme, we observe that S3 makes better tradeoff between the encoder complexity and BD-rates
- ❑ We recommend adopting it to the HM software as default behaviour.



Thanks!

