

Second Order Prediction (JCTVC-B079)

Shangwen Li, Lu Yu

Zhejiang University

yul@zju.edu.cn





Outline

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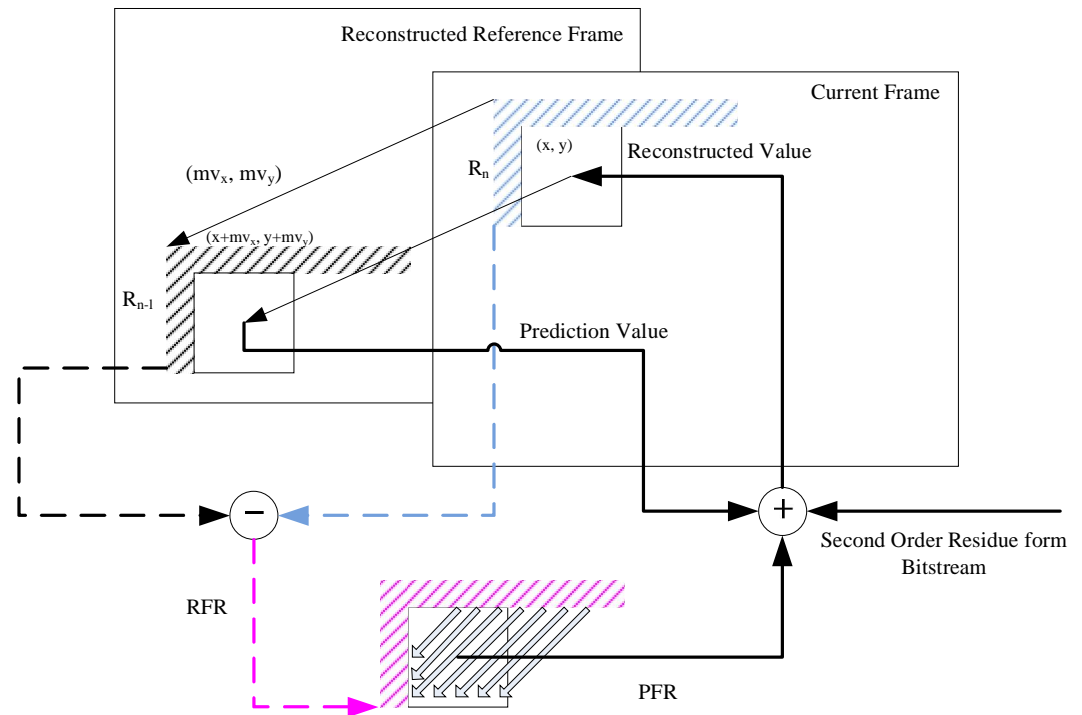
Second Order Prediction Process

z Inputs:

- y reconstructed samples of current frame
- y reconstructed samples of reference frame
- y motion vectors of current macroblock

z Output:

- y reconstructed samples





Derivation Process for Reference Residue of the Second Prediction

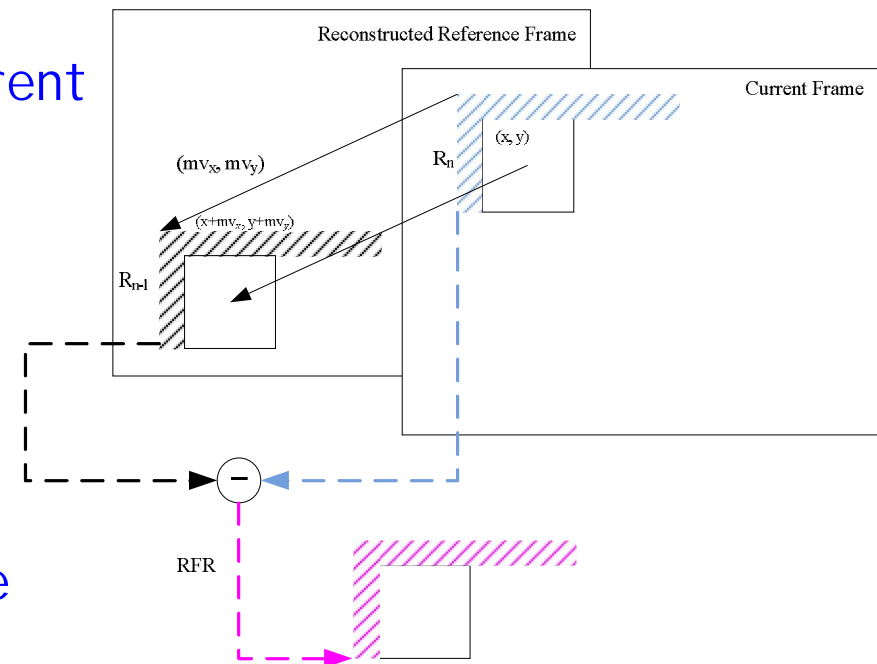
z Inputs:

- y reconstructed samples of current frame R_n
- y reconstructed samples of reference frame R_{n-1}
- y motion vectors of current macroblock

z Output:

- y reference first-order residue (RFR)

$$\text{RFR}(x+d'_x, y+d'_y) = R_n(x+d'_x, y+d'_y) - R_{n-1}(x+d'_x + mv_x, y+d'_y + mv_y)$$





The Second Prediction

z Inputs:

y RFR

y second prediction mode

z Output:

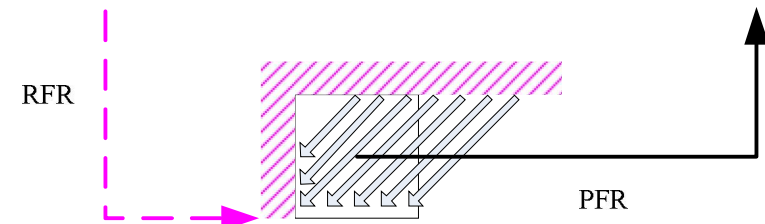
y prediction values of first-order residue
PFR

z Intra prediction size

y Intra prediction size can be 4x4 or 8x8

y Transform size = Intra prediction size

y Nine 8x8 intra prediction modes or nine
4x4 intra prediction modes in H.264





Derivation of Reconstructed Samples

z Inputs :

y PFR

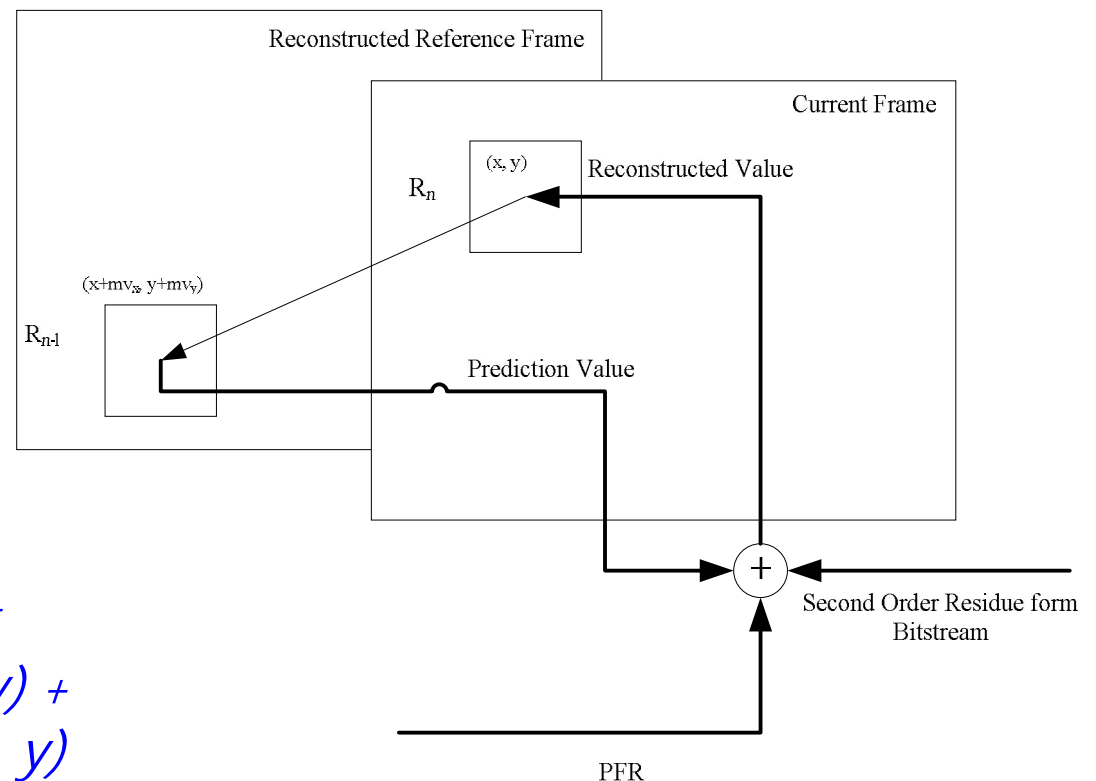
y decoded second order residue

y Motion-compensated prediction values

z Output :

y reconstructed samples

$$\begin{aligned} \text{Reconstructed sample}(x, y) = \\ R_{n-1}(x+mv_x, y+mv_y) + PFR(x, y) + \\ \text{Second-Order Residue}(x, y) \end{aligned}$$





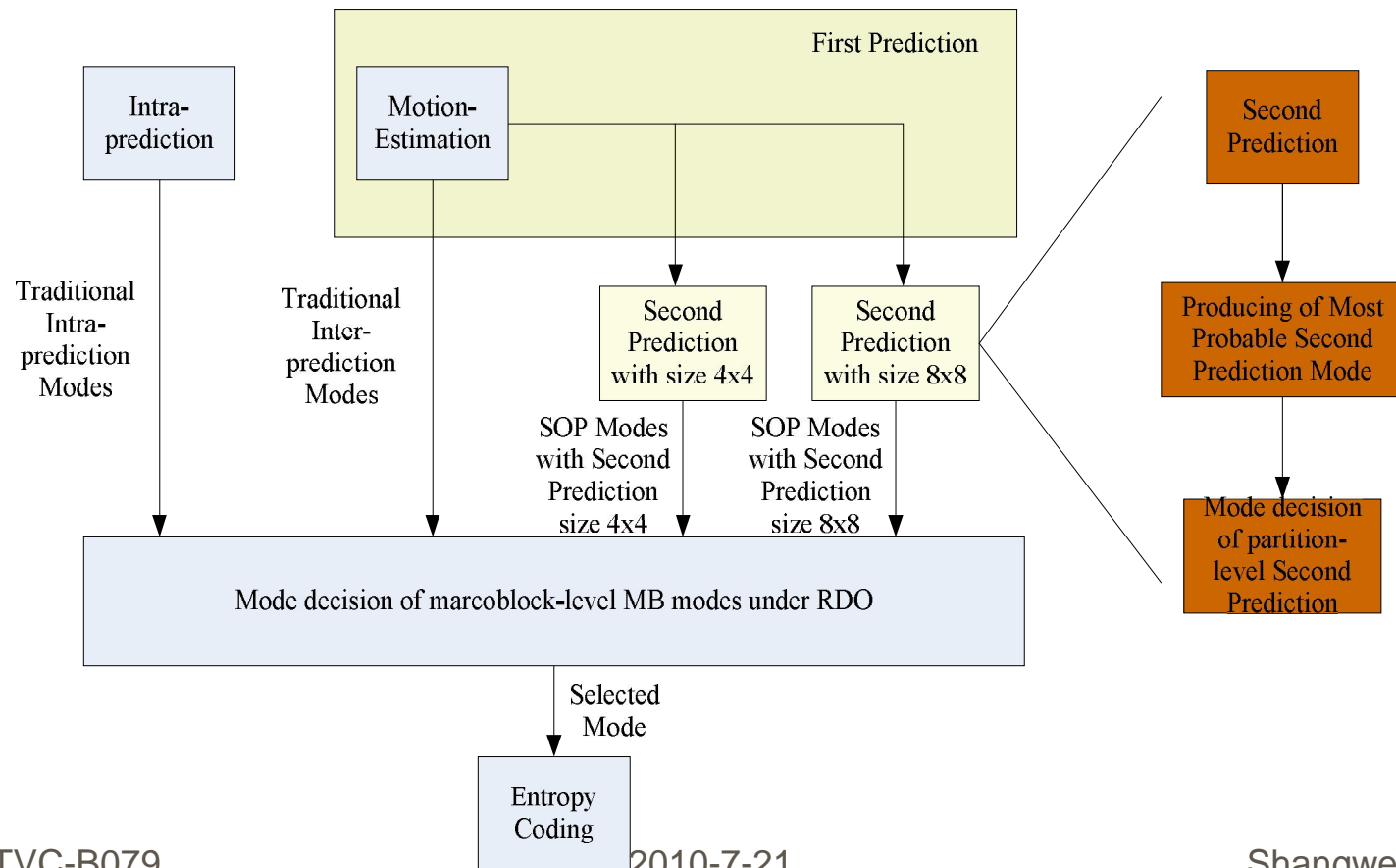
The Syntax of Second Order Prediction

- z sop_flag
 - y sop_flag is used to indicate the usage of SOP technique at macroblock level.
- z Mode indicator of the second prediction mode
 - y pred_sp_mode_flag
 - y rem_sp_mode
- z When a macroblock is indicated as a SOP macroblock, transform_size_8x8_flag is always presented in the bitstream. In the SOP macroblock, transform_size_8x8_flag not only indicates transform size but also the second prediction block size.



Encoder Implementation of SOP

Rate-Distortion Optimization Criteria of SOP





Simulation Results

- z JM11.0 KTA2.6r1
- z Conformance with High Profile
- z I bBbBbBbP and and I PPPP coding structure
- z CABAC, 8x8 transforms enabled
- z RDOQ enabled (fast mode, NUM=1)
- z Adaptive rounding disabled
- z Weighted prediction enabled
- z Fast motion estimation (range 128x128)
- z Number of frames: first 100 frames (Kimono use the last 100 frames)
- z The QP values as used in [6] will be used.



Test Result of SOP

test sequences		SOP BD-rate saving [7] (%)	
		IbBbBbBbP	IPPP
Class B	BasketballDrive	-1.71	-2.70
	Cactus	-2.52	-3.16
	Kimono	-0.91	-1.63
	ParkScene	-0.14	-0.77
	average B	-1.32	-2.07
Class C	BasketballDrill	-3.07	-2.84
	PartyScene	-1.22	-1.20
	RaceHorses	-0.73	-1.09
	BQMall	-1.46	-1.32
	average C	-1.62	-1.61
Class E	vidyo1	NA	-2.59
	vidyo3		-2.37
	vidyo4		-2.28
	average E		-2.41
Total average		-1.47	-2.03



Conclusion

- z Second Order Prediction (SOP) is proposed to eliminate remaining spatial correlation of motion-compensated prediction residue by using intra prediction.
- z The experiments results show that SOP can achieve on average 1.47% BD bit-rate saving for I bBbBbBbP coding structure and 2.03% for I PPP coding structure.



Thanks for your attention!

Question?

