

Intra prediction based on repetitive pixel replenishment with adaptive block size (JCTVC-D251)

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Introduction

■ Previous work (JCTVC-C189)

- Renesas proposed intra prediction based on repetitive pixel replenishment (**Intra RPR**)
 - using more pixels, using more directions
- Intra RPR parameter condition
 - Template block size: **8x8 (fixed)**
 - Search precision: **integer pixel**
- Performance on TMuC 0.1
 - BD-rate (Intra) : -0.8 % (Y), -1.2% (U), -1.3% (V)

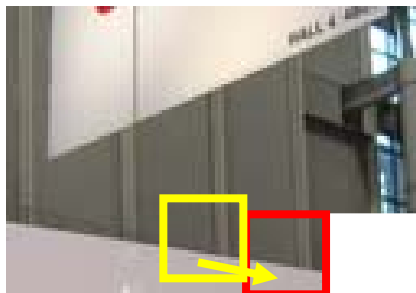
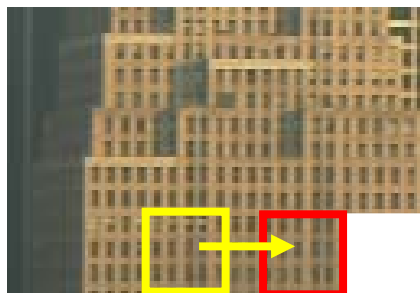
■ This contribution presents evaluation on Intra RPR with adaptive block size and fractional pixel precision.

- Performance on **TMuC 0.9**
 - BD-rate (Intra) : **-1.8 % (Y), -1.4% (U), -1.3% (V)**

Motivation

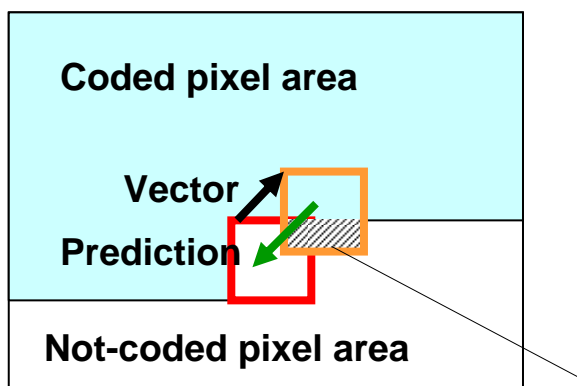
■ Basic idea

- NOT enough quality of predicted image by conventional intra prediction caused by using only neighboring pixels.
- Applying **2-D template matching** to intra prediction.



Examples fit for
block matching
rather than AVC.

■ Traditional issue

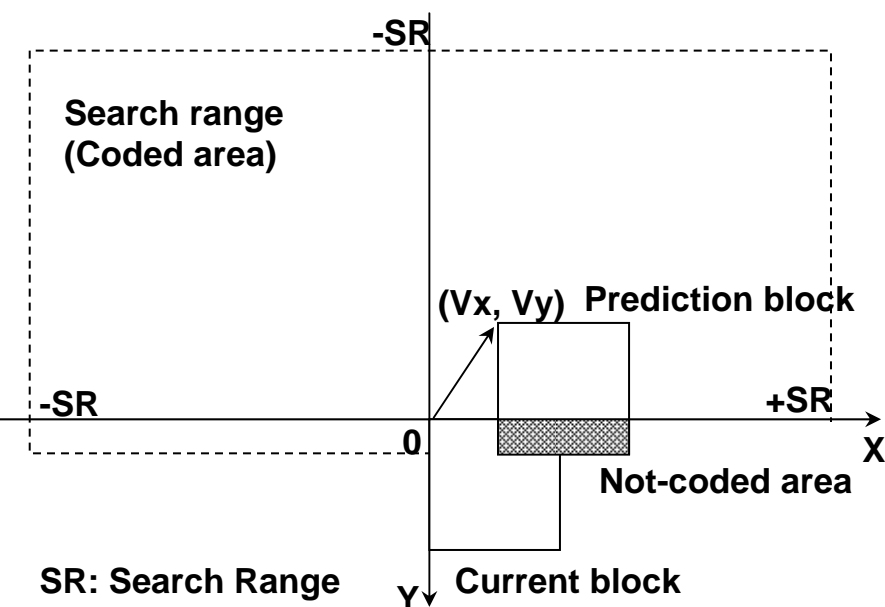


Invalid to be used

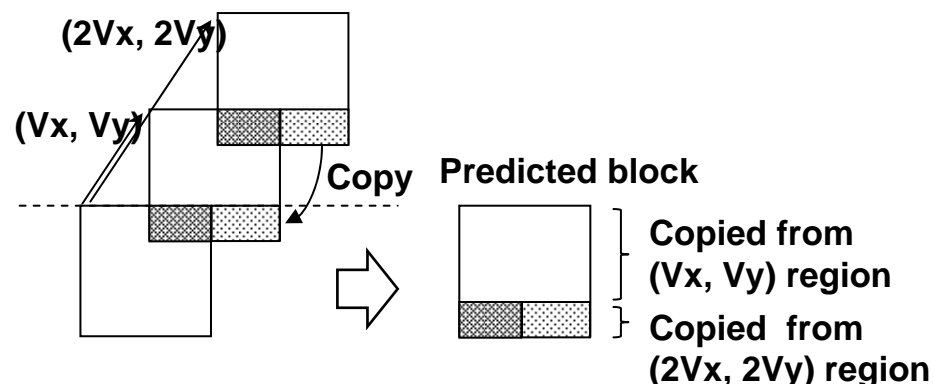
- Nearer image is more similar at the most case.
- But, nearer image has more not-coded pixels in reference block.
- How these pixels are processed greatly affects coding efficiency.

Repetitive pixel replenishment

- If reference block includes a not-coded area, intra vector is multiplied as $(2Vx, 2Vy)$, and adaptively padding such region by using new reference pixel as shown in Fig. (b).
- Intra vectors are signaled as side information.
 - Adaptive template block size
 - Hal-pel precision search
 - Modified VLC table for motion vector



(a) Intra vector prediction



(b) Adaptive padding

Performance evaluation of Intra RPR on TMuC

■ Condition

- Intra RPR parameter setting
 - Search range: horizontal [-16, 16], vertical [-16, 0]
 - Template block size: 4x4, 8x8, 16x16, 32x32, 64x64 (adaptively)
 - Search precision: integer pixel + hal-pel precision
 - Motion vectors: modified VLC table
- TMuC 0.9
 - Intra, Intra LoCo, Radom access, Random access LoCo
- Experimental condition
 - QP : 22, 27, 32, 37
 - First 60 pictures of all sequence, Intra-only

Performance evaluation of Intra RPR on TMuC

■ BD-rate reduction

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-1.3	-1.0	-0.9	-0.3	0.1	0.2
Class B	-1.6	-1.4	-1.3	-0.9	-0.4	-0.5
Class C	-2.4	-1.8	-1.7	-1.5	-1.1	-1.1
Class D	-1.4	-1.2	-1.1	-0.9	-0.2	-0.4
Class E	-1.9	-1.5	-1.4	-0.8	0.5	0.4
All	-1.8	-1.4	-1.3	-1.0	-0.3	-0.4

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-1.0	-1.0	-0.5	-0.3	0.2	0.0
Class B	-1.2	-1.1	-1.3	-0.6	-0.4	-0.6
Class C	-1.8	-1.1	-0.4	-0.9	-0.4	-0.5
Class D	-0.9	-0.6	-1.3	-0.4	-0.2	-0.1
Class E						
All	-1.3	-0.9	-0.9	-0.6	-0.3	-0.4

■ Complexity

- Encoding time : 381% (Intra) , 203% (Random access)
(Not optimized yet)

Performance results of Intra RPR on TMuC

■ Results of each sequence on Intra

		BD-rate Y	BD-rate U	BD-rate V
Class A	Traffic	-1.1	-0.8	-0.8
	PeopleOnStreet	-1.5	-1.3	-1.0
Class B	Kimono	-0.5	-0.3	-0.3
	ParkScene	-1.6	-1.1	-1.0
	Cactus	-2.7	-2.2	-2.3
	BasketballDrive	-0.6	-1.0	-0.8
	BQTerrace	-2.7	-2.4	-2.3
Class C	BasketballDrill	-5.0	-4.1	-4.2
	BQMall	-2.4	-1.9	-1.4
	PartyScene	-0.8	-1.1	-1.2
	RaceHorses	-1.3	-0.3	-0.1
Class D	BasketballPass	-2.8	-2.8	-2.3
	BQSquare	-1.7	-1.0	-1.1
	BlowingBubbles	-0.5	-0.4	-0.5
	RaceHorses	-0.7	-0.7	-0.4
Class E	Vidyo1	-1.8	-1.2	-0.8
	Vidyo3	-2.9	-1.7	-3.0
	Vidyo4	-0.9	-1.4	-0.5
Average		-1.8	-1.4	-1.3

Conclusion

- Renesas proposed intra prediction based on repetitive pixel replenishment (**Intra RPR**).
 - Adaptive template block size
 - Hal-pel precision search
 - Modified VLC table for motion vector

- Performance on TMuC
 - BD-rate (Intra) : **-1.8 %**, **-1.4%**, **-1.3%**, and up to **-5.0%**, **-4.1%**, **-4.2%**
 - BD-rate (R. A.) : **-1.3 %**, **-0.9%**, **-0.9%**, and up to **-2.8%**, **-1.6%**, **-1.6%**
 - Encoding time : **203%** (Random access), **381 %**(Intra)

- Further examination of Intra RPR **in CE**
 - Optimize vector representation
 - Harmonization with other intra coding tools



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