

Description of video coding technology proposal by Renesas (JCTVC-A126)

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Summary

■ Coding tools

- Intra repetitive pixel replenishment using block matching
- 2D adaptive interpolation filter (2D-AIF)
- Motion vector competition
- Extended block sizes (ExtMB): 32x32, 32x16, 16x32

■ Experimental results

- Set 1: BD-Bitrate 20.67 %, BD-PSNR 0.85 dB
- Set 2: BD-Bitrate 11.79 %, BD-PSNR 0.49 dB

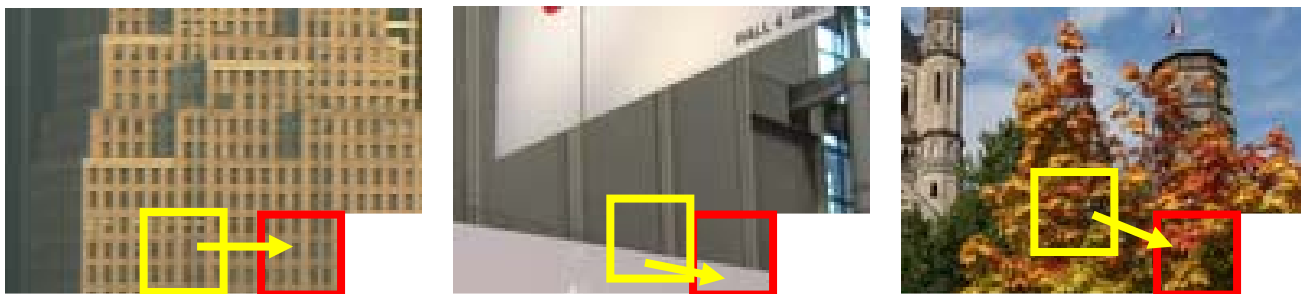
Improvement of intra coding efficiency

■ Motivation

- 26% of total bits is derived from **Intra picture**, which is the average of alpha anchor. (53% at the maximum case of alpha anchor)
- Improvement of Intra picture quality effects coding efficiency of following inter predicted picture.
- Otherwise ...
 - AVC intra predicted image does **NOT** have **enough quality**.
 - AVC intra prediction uses **only neighboring pixels** of target MB.

■ Basic idea

- **Intra vector prediction** by block matching
- Prediction from **more pixels** improves predicted image quality.

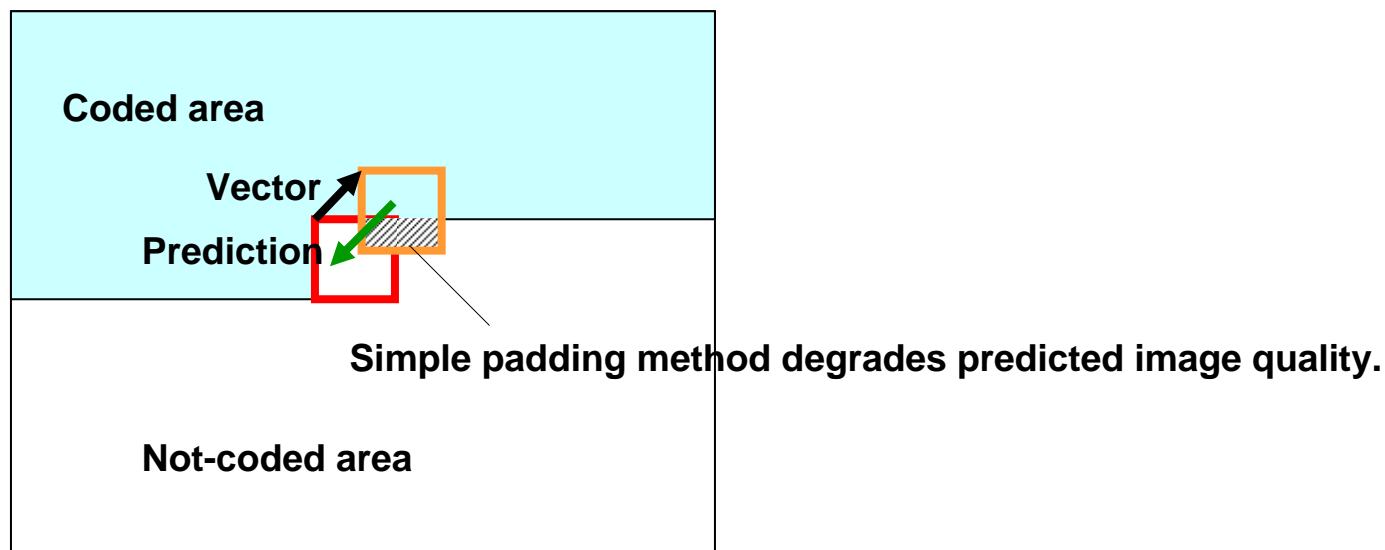


Examples fit for block matching and unfit for AVC intra prediction

Problem of intra vector prediction

■ Problem of intra vector prediction

- **Prediction** from closer pixels must derive better quality.
- Otherwise, neighboring area is not coded yet.

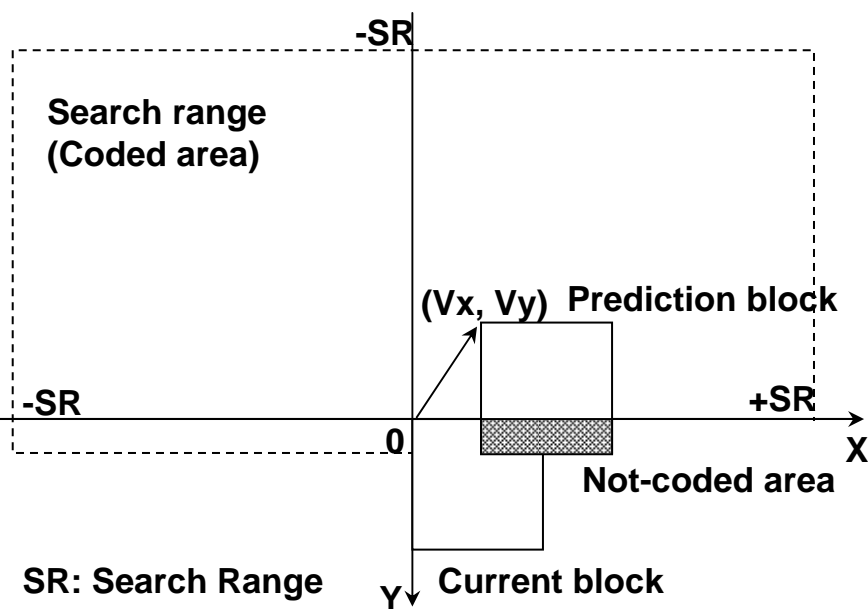


■ Proposal

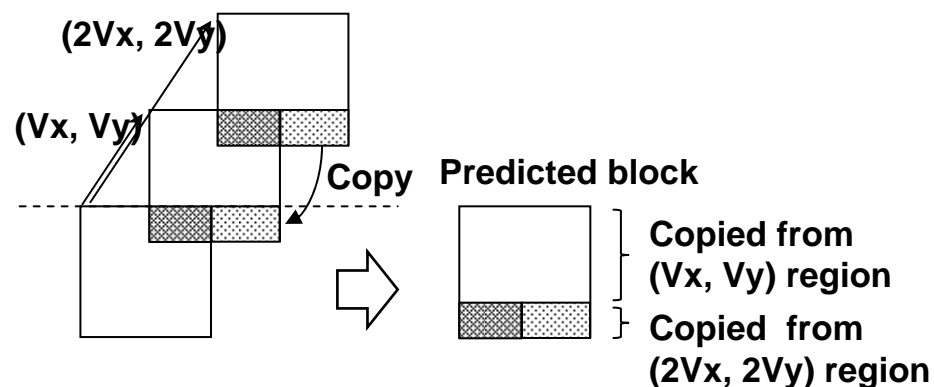
- **Pixel replenishment** based on **repetitive characteristics** of objects

Intra 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).
- This scheme is especially effective to predict the cyclic patterns.



(a) Intra vector prediction



(b) Adaptive padding

Effect of intra repetitive pixel replenishment

- Predicted image quality was improved significantly.

Anchor



Proposal



Anchor



Proposal



S08 : BasketballDrill Frame 0, CS1-384kbit/s

Complexity study for intra repetitive pixel replenishment

- Block matching for intra vector prediction is quite low complexity compared to the inter prediction.
- Hardware implements ALUs for required maximum performance, i.e. inter-frame prediction.

Comparison with inter-frame prediction

	Search area	Block size	No. of points
This method	544 (16x33+16)	8x8	2,176
Inter-frame prediction (P-frame)	16,384 (128x128)	16x16, 16x8, 8x16, 8x8	147,456

Experimental results

- 2D-AIF, MV competition , ExtMB are also introduced.
- Constrained set 1

Test Class	BD-Value	
	BD-Bitrate (%)	BD-PSNR (dB)
Class A	-16.92	0.77
Class B	-21.77	0.70
Class C	-23.07	1.06
Class D	-18.76	0.88
Total	-20.67	0.85

- Constrained set 2

Test Class	BD-Value	
	BD-Bitrate (%)	BD-PSNR (dB)
Class B	-18.96	0.67
Class C	-10.10	0.45
Class D	1.06	0.05
Class E	-19.24	0.82
Total	-11.79	0.49

Complexity results

■ Condition

- Including YUV output, reference input
- Linux SLES9 64bit , Xeon quad-core CPU 3.0 GHz, 8GB RAM

■ Encoding time

Class	Encoding time (hour)	
	Set 1	Set 2
Class A	41.52	-
Class B	60.88	51.35
Class C	13.96	12.47
Class D	4.99	4.52
Class E	-	39.30

■ Decoding time

Constrained set 1

Class	Decoding time (sec)		Ratio (proposal/anch)
	Alpha anchor	Proposal	
Class A	31.17	250.94	8.05
Class B	43.36	393.84	9.08
Class C	8.83	60.03	6.80
Class D	2.61	19.87	7.60

Constrained set 2

Class	Decoding time (sec)		Ratio (proposal/anch)
	Beta anchor	Proposal	
Class B	32.91	385.65	11.72
Class C	7.32	70.31	9.61
Class D	2.27	19.76	8.72
Class E	15.81	123.56	7.81

Conclusion

- **Renesas presented a response to CfP featuring a novel intra-frame prediction based on repetitive pixel replenishment.**

- **Experimental results**
 - **Set 1: BD-Bitrate 20.67 %, BD-PSNR 0.85 dB**
 - **Set 2: BD-Bitrate 11.79 %, BD-PSNR 0.49 dB**

- **Further examination in core experiments**
 - **Half/Quarter pixel vector with AIF**
 - **Apply to P/B frames**
 - **Further reduction in vector representation**



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