Intra prediction based on repetitive pixel replenishment (JCTVC-B033)

2nd Meeting: Geneva, CH, 21-28 July, 2010

Renesas Electronics Corporation

Kenichi Iwata, Seiji Mochizuki, Ryoji Hashimoto

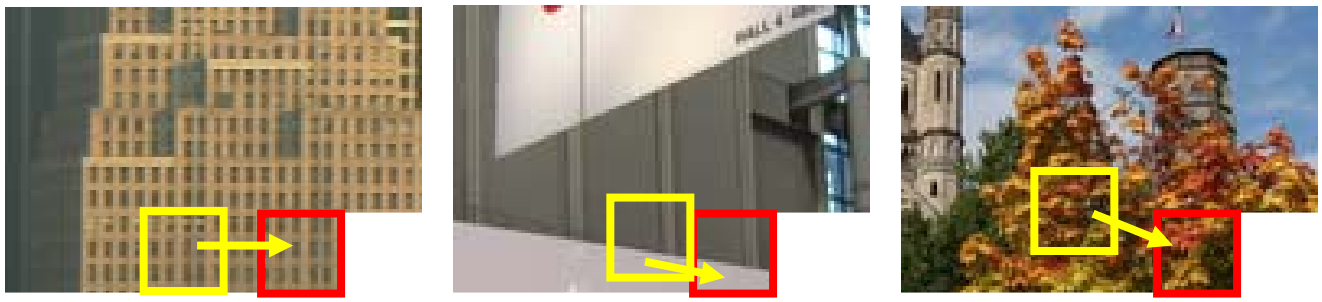
Improvement of intra coding efficiency

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.
- On the other hand,
  - AVC intra predicted image does NOT have enough quality.
  - AVC intra prediction uses only neighboring pixels of target MB.

Basic idea

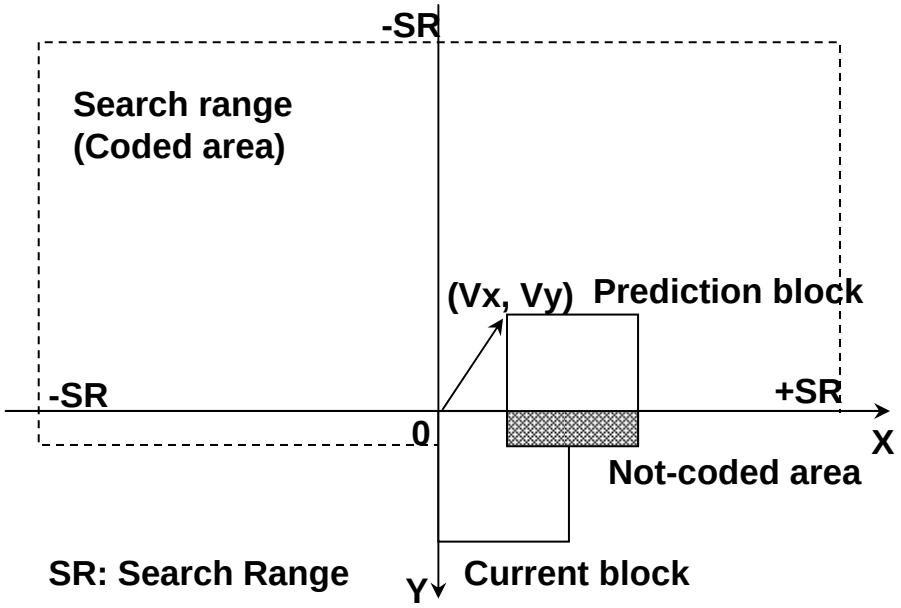
- Prediction from more pixels improves predicted image quality
- Prediction from more directions by 2-D template matching



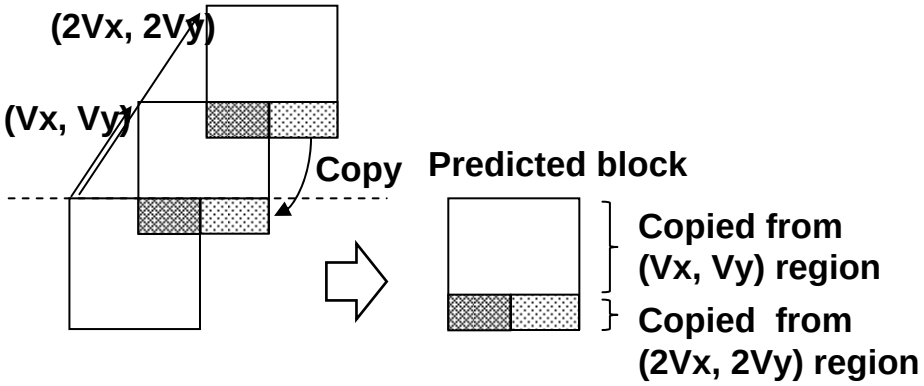
Examples fit for block matching and unfit for AVC intra prediction

Intra repetitive pixel replenishment (Intra RPR)

- 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.

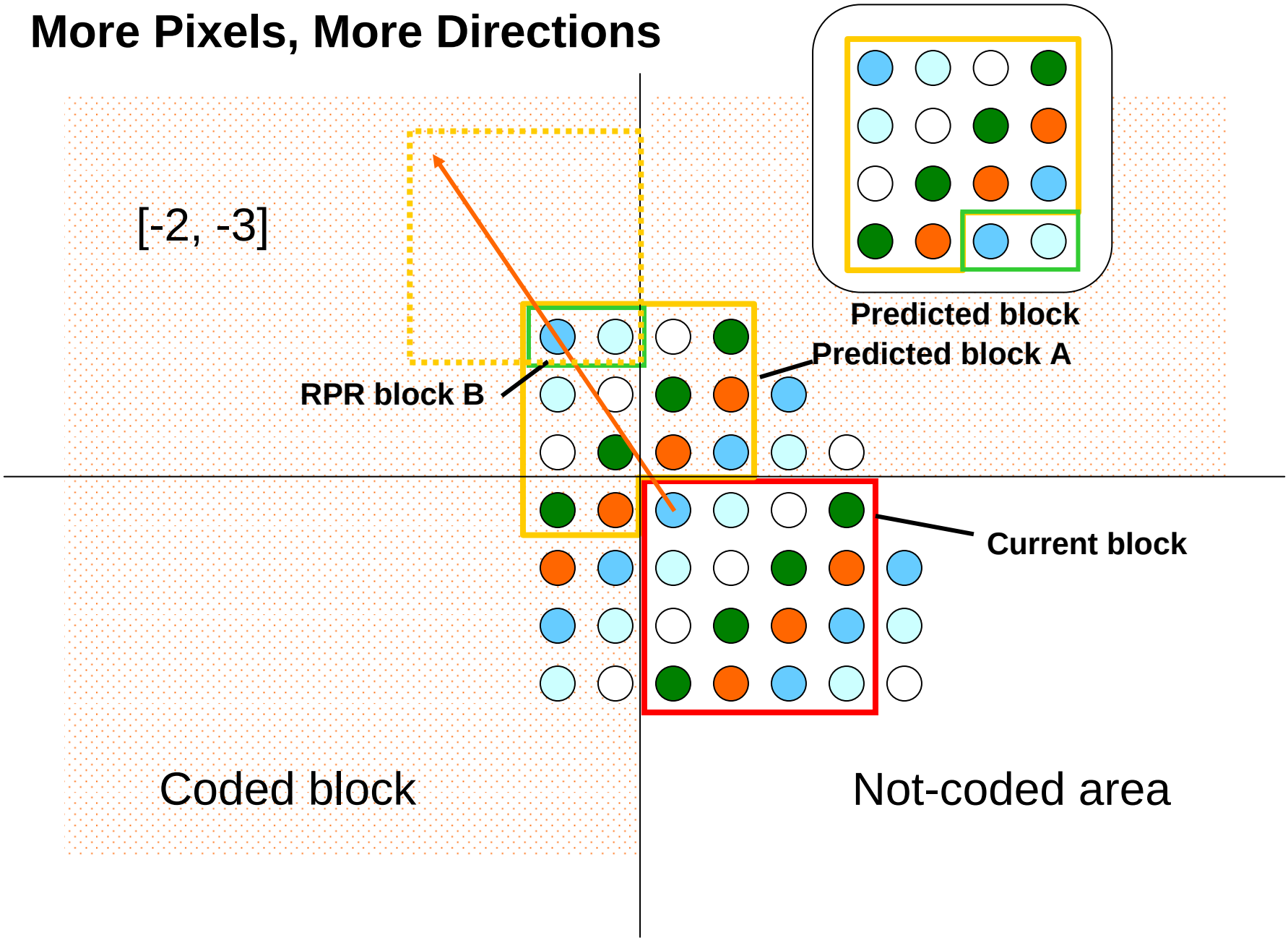


(a) Intra vector prediction

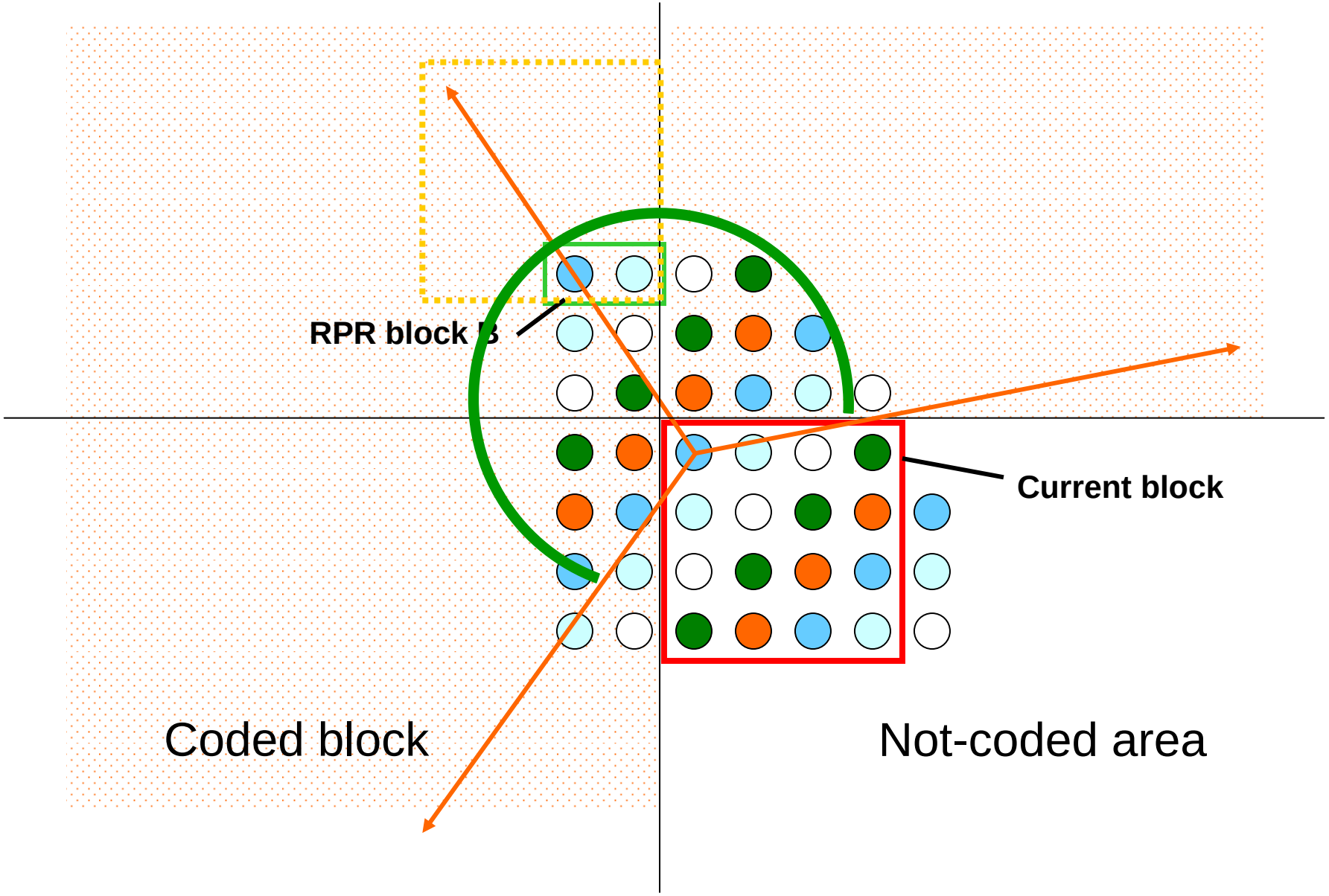


(b) Adaptive padding

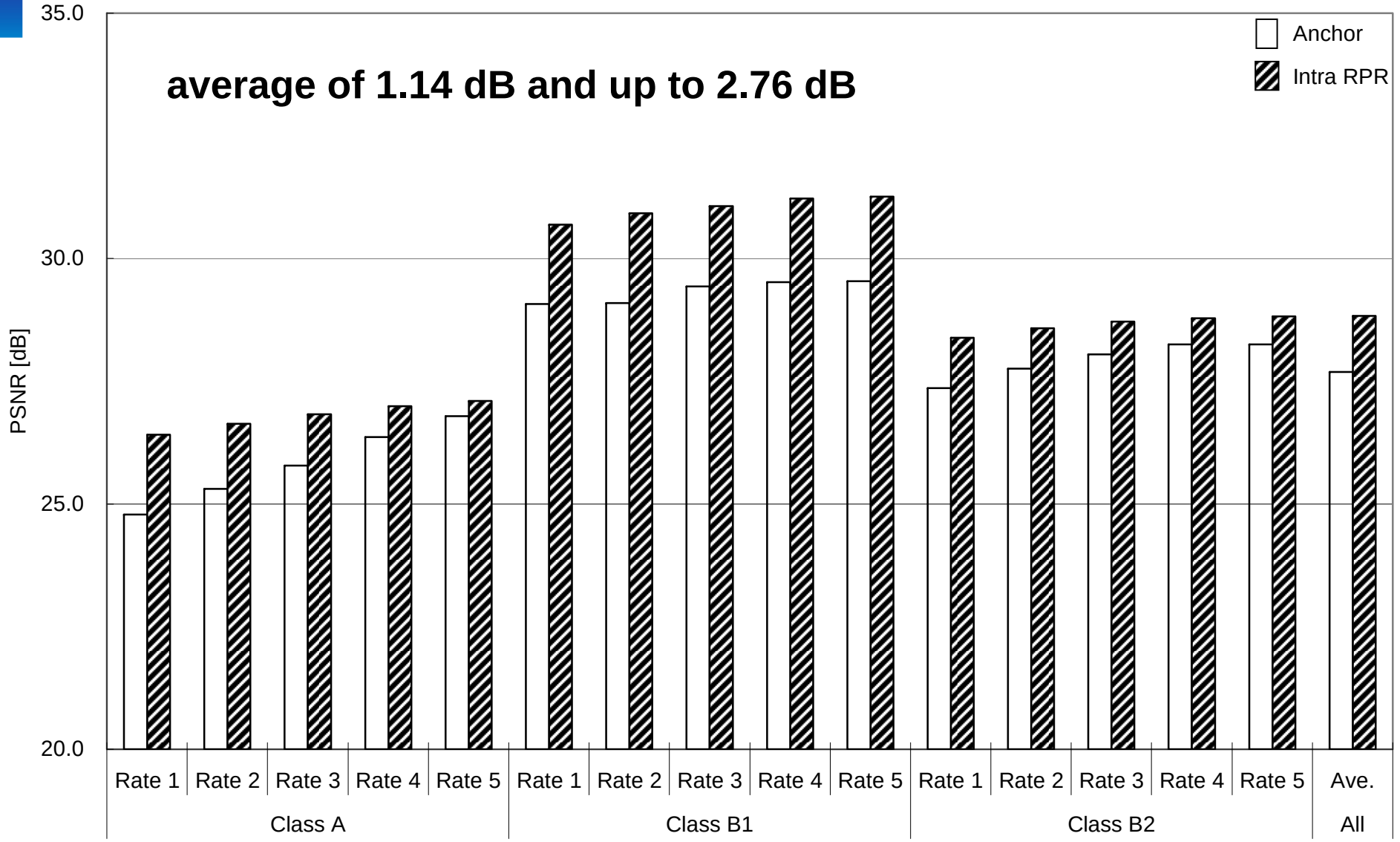
More Pixels, More Directions



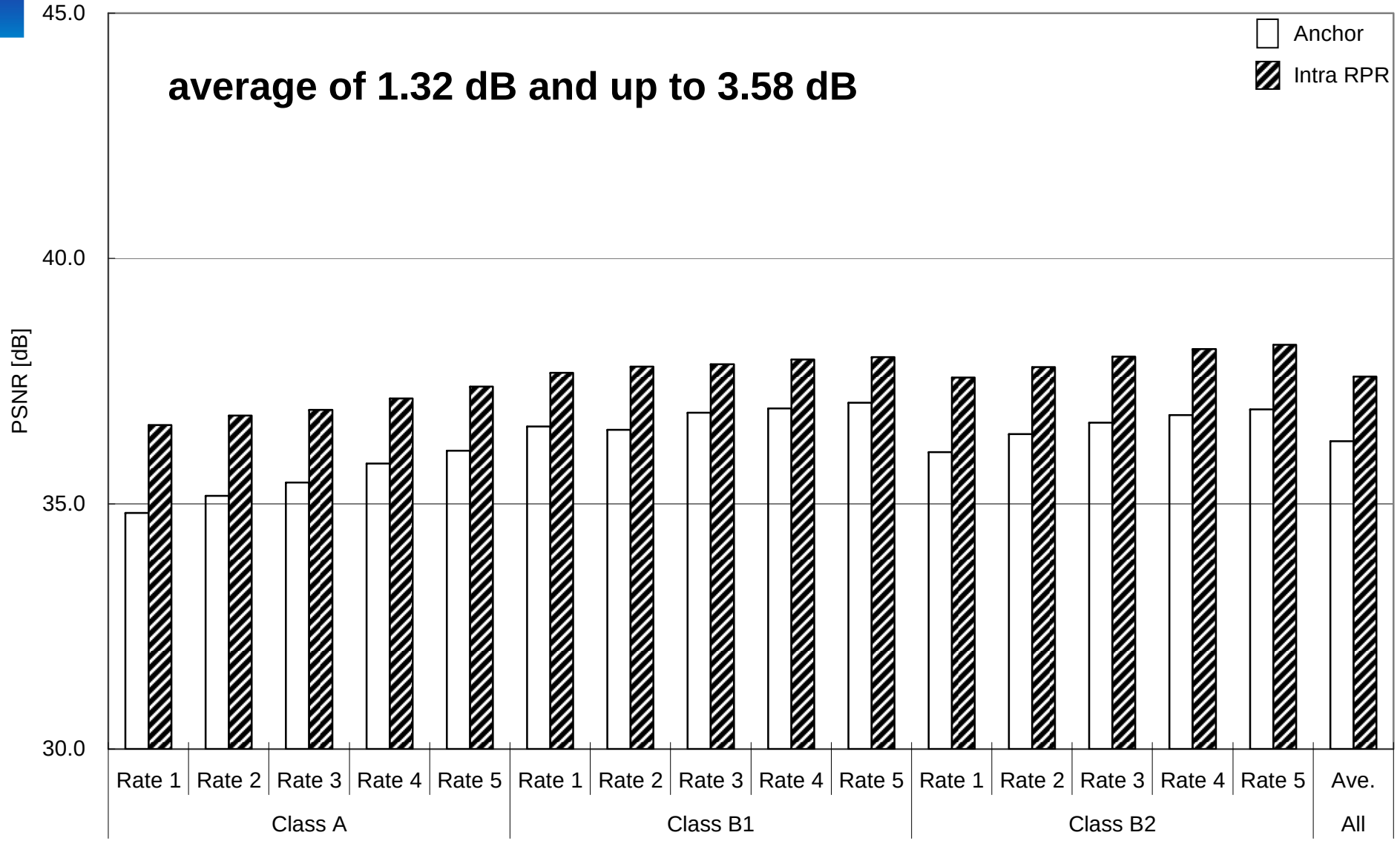
More Pixels, More Directions



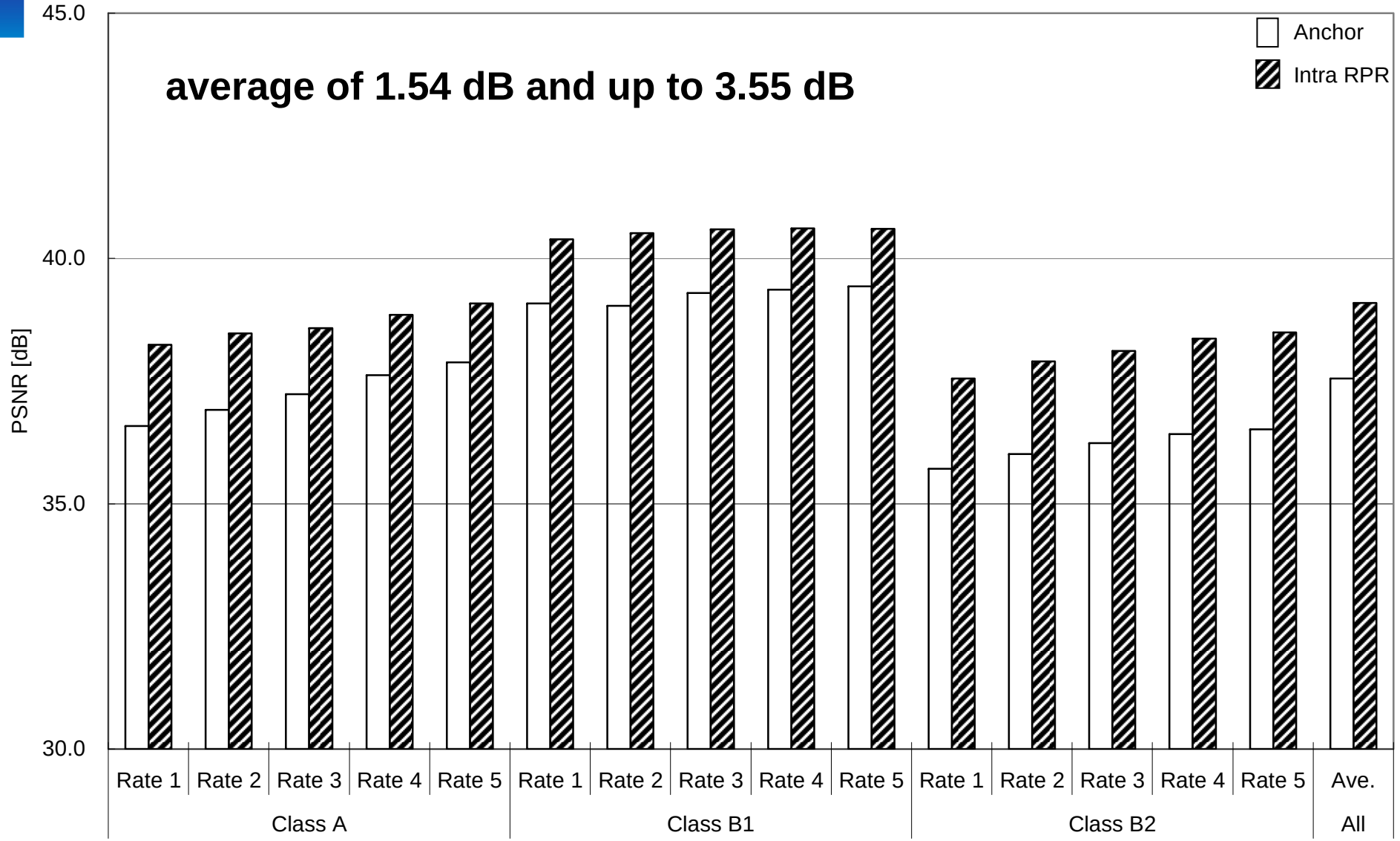
Predicted Image Evaluation (PSNR_Y)



Predicted Image Evaluation (PSNR_U)



Predicted Image Evaluation (PSNR_V)



Predicted Image of Anchor (P01S08R1C1, Frame 0)

Predicted Image of Proposal (PxxS08R1C1, Frame 0)

Performance results of Intra RPR on TMuC

C	Sequence	TNuC				Proposal				Difference		BD-Value	
		Rate (kbps)	Y-PSNR (dB)	U-PSNR (dB)	V-PSNR (dB)	Rate (kbps)	Y-PSNR (dB)	U-PSNR (dB)	V-PSNR (dB)	ΔBitrate(%)	ΔPSNR	BD-Bitrate	BD-PSNR
	Basketball Drill	21730.00	40.99	43.27	44.00	21420.40	41.08	43.42	44.13	-1.45	0.09	-4.78	0.22
		13386.80	38.24	41.07	41.58	13037.20	38.31	41.18	41.73	-2.68	0.07		
		8158.80	35.98	39.21	39.52	7854.80	36.06	39.34	39.63	-3.87	0.08		
		4886.00	33.85	37.10	37.29	4794.00	34.03	37.23	37.40	-1.92	0.18		
		2937.20	31.87	35.26	35.07	2922.80	32.02	35.22	35.27	-0.49	0.15		
	BQMall	28931.52	40.84	42.79	44.04	28796.64	40.98	42.92	44.27	-0.47	0.14	-4.01	0.25
		19957.44	38.28	40.81	41.87	19809.60	38.45	40.91	41.88	-0.75	0.17		
		13384.80	35.64	39.31	40.07	13281.60	35.88	39.44	40.35	-0.78	0.24		
		8478.72	32.97	37.46	38.30	8418.24	33.21	37.68	38.49	-0.72	0.23		
		5232.96	30.47	35.98	36.64	5142.72	30.66	35.92	36.76	-1.75	0.19		

Only I-picture

Intra RPR conditions:
- Search range: horizontal [-16, 16], vertical [-16, 0]
- Template block size: 8x8 (fixed)
- Search precision: integer pixel

Conclusion

- Renesas proposed intra prediction based on repetitive pixel replenishment (Intra RPR).
  - using more pixels
  - using more direction

- Our predicted image had PSNR gain against alpha anchor CfP.
  - PSNR_Y: average of 1.14 dB and up to 2.76 dB
  - PSNR_U: average of 1.32 dB and up to 3.58 dB
  - PSNR_V: average of 1.54 dB and up to 3.55 dB

- Performance on TMuC
  - Class C (BacketballDrill) : BD-bitrate: -4.78 %, BD-PSNR 0.22 dB
  - Class C (BQMall) : BD-bitrate: -4.01 %, BD-PSNR 0.25 dB

- Further examination in tool experiments with TMuC
  - Common test condition in AHG on Intra Prediction

Renesas Electronics Corporation