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Title [INVR] On the curvature of MIV RD-curves using INVR methodology

Source PUT

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Abstract

This document presents how performing the quality calculation only for some (only for non-transmitted) views influences the curvature of RD-curves on the MIV CTC test set.

1 The experiment

MIV CTC defines that in the MIV DSDE scenario not all the views are sent within atlases, even if there is free space (to ensure that we assess the quality of entire MIV processing, not just the video codec).

Therefore, it is easy to quickly gather TMIV results on all the MIV CTC test sequences using the current INVR methodology (estimating the metrics only for non-transmitted views). In this experiment, nothing needed to be rerun, and all the results are based on analysis of the TMIV anchor reporting template.

Below there is an example – sequence J02 (Cadillac) – where among 15 input views, 12 were transmitted within atlases (even though there is space for 16 views) and three (v6, v7, and v8) were not.

View Synthesis [MIV DSDE]									View Synthesis [MIV DSDE]										
View		Y-MSE	Y-PSNR	U-PSNR	V-PSNR	IV-MSE	IV-PSNR	Total T [s]	View		Y-MSE	Y-PSNR	U-PSNR	V-PSNR	IV-MSE	IV-PSNR	Total T [s]		
v0	RP0	4.6E-05	43.38	58.03	61.19	6.1E-06	52.16	52020	v0	RP0									
	RP1	7.4E-05	41.32	47.45	49.05	1.3E-05	48.74	32298		RP1									
	RP2	1.1E-04	39.50	43.87	45.44	2.5E-05	46.03	43604		RP2									
	RP3	2.1E-04	36.71	40.45	42.19	5.2E-05	42.82	70915		RP3									
	RP4	5.6E-04	32.53	37.58	39.17	1.5E-04	38.36	67407		RP4									
v1	RP0	4.9E-05	43.12	57.76	60.88	5.6E-06	52.50	52020	v1	RP0									
	RP1	7.7E-05	41.11	47.27	48.83	1.4E-05	48.44	32298		RP1									
	RP2	1.2E-04	39.23	43.79	45.30	2.6E-05	45.81	43604		RP2									
	RP3	2.2E-04	36.48	40.43	42.04	5.5E-05	42.62	70915		RP3									
	RP4	5.9E-04	32.29	37.50	39.09	1.5E-04	38.18	67407		RP4									
v2	RP0	5.4E-05	42.72	57.74	60.83	6.1E-06	52.11	52020	v2	RP0									
	RP1	8.4E-05	40.76	47.11	48.62	1.5E-05	48.33	32298		RP1									
	RP2	1.3E-04	38.96	43.60	45.14	2.7E-05	45.75	43604		RP2									
	RP3	2.4E-04	36.28	40.27	41.88	5.6E-05	42.50	70915		RP3									
	RP4	6.1E-04	32.17	37.25	39.01	1.6E-04	38.03	67407		RP4									
v3	RP0	5.5E-05	42.60	57.80	60.59	6.0E-06	52.25	52020	v3	RP0									
	RP1	8.5E-05	40.72	47.03	48.37	1.4E-05	48.40	32298		RP1									
	RP2	1.3E-04	38.91	43.52	44.95	2.7E-05	45.75	43604		RP2									
	RP3	2.4E-04	36.16	40.28	41.78	5.7E-05	42.42	70915		RP3									
	RP4	6.2E-04	32.08	37.28	38.75	1.6E-04	37.88	67407		RP4									
v4	RP0	5.7E-05	42.43	58.11	60.84	6.2E-06	52.06	52020	v4	RP0									
	RP1	8.1E-05	40.92	47.40	48.58	1.4E-05	48.60	32298		RP1									
	RP2	1.2E-04	39.17	44.02	45.23	2.5E-05	46.09	43604		RP2									
	RP3	2.1E-04	36.81	40.76	42.08	5.0E-05	42.98	70915		RP3									
	RP4	5.0E-04	32.97	37.89	39.01	1.4E-04	38.69	67407		RP4									
v5	RP0	4.6E-05	43.36	57.11	60.34	6.4E-06	51.96	52020	v5	RP0									
	RP1	7.1E-05	41.46	47.35	48.91	1.3E-05	48.90	32298		RP1									
	RP2	1.1E-04	39.68	44.09	45.64	2.3E-05	46.31	43604		RP2									
	RP3	1.9E-04	37.15	40.74	42.40	4.8E-05	43.16	70915		RP3									
	RP4	4.6E-04	33.37	37.90	39.53	1.2E-04	39.06	67407		RP4									
v6	RP0	7.4E-04	31.32	38.67	41.20	1.8E-04	37.47	52020	v6	RP0	7.4E-04	31.32	38.67	41.20	1.8E-04	37.47	52020		
	RP1	7.7E-04	31.13	38.23	40.78	2.0E-04	37.03	32298		RP1	7.7E-04	31.13	38.23	40.78	2.0E-04	37.03	32298		
	RP2	8.2E-04	30.84	37.36	40.31	2.3E-04	36.42	43604		RP2	8.2E-04	30.84	37.36	40.31	2.3E-04	36.42	43604		
	RP3	8.9E-04	30.52	36.44	39.47	2.6E-04	35.83	70915		RP3	8.9E-04	30.52	36.44	39.47	2.6E-04	35.83	70915		
	RP4	1.2E-03	29.22	35.66	38.07	3.7E-04	34.31	67407		RP4	1.2E-03	29.22	35.66	38.07	3.7E-04	34.31	67407		
v7	RP0	8.3E-04	30.82	38.15	40.72	2.0E-04	37.06	52020	v7	RP0	8.3E-04	30.82	38.15	40.72	2.0E-04	37.06	52020		
	RP1	8.6E-04	30.64	37.74	40.34	2.2E-04	36.63	32298		RP1	8.6E-04	30.64	37.74	40.34	2.2E-04	36.63	32298		
	RP2	9.2E-04	30.35	36.95	39.91	2.5E-04	36.01	43604		RP2	9.2E-04	30.35	36.95	39.91	2.5E-04	36.01	43604		
	RP3	1.0E-03	30.02	36.06	39.09	2.9E-04	35.38	70915		RP3	1.0E-03	30.02	36.06	39.09	2.9E-04	35.38	70915		
	RP4	1.4E-03	28.61	35.28	37.72	4.3E-04	33.66	67407		RP4	1.4E-03	28.61	35.28	37.72	4.3E-04	33.66	67407		
v8	RP0	7.2E-04	31.40	38.67	41.36	1.6E-04	37.92	52020	v8	RP0	7.2E-04	31.40	38.67	41.36	1.6E-04	37.92	52020		
	RP1	7.5E-04	31.26	38.22	40.85	1.8E-04	37.47	32298		RP1	7.5E-04	31.26	38.22	40.85	1.8E-04	37.47	32298		
	RP2	8.0E-04	30.98	37.29	40.32	2.1E-04	36.83	43604		RP2	8.0E-04	30.98	37.29	40.32	2.1E-04	36.83	43604		
	RP3	8.8E-04	30.56	36.41	39.41	2.5E-04	36.08	70915		RP3	8.8E-04	30.56	36.41	39.41	2.5E-04	36.08	70915		
	RP4	1.3E-03	28.80	35.51	37.86	4.0E-04	33.94	67407		RP4	1.3E-03	28.80	35.51	37.86	4.0E-04	33.94	67407		
v9	RP0	5.8E-05	42.35	56.98	59.64	7.0E-06	51.53	52020	v9	RP0									
	RP1	8.9E-05	40.49	46.76	47.97	1.5E-05	48.23	32298		RP1									
	RP2	1.3E-04	38.73	43.50	44.74	2.7E-05	45.64	43604		RP2									
	RP3	2.4E-04	36.24	40.42	41.66	5.7E-05	42.46	70915		RP3									
	RP4	5.5E-04	32.63	37.50	38.63	1.5E-04	38.22	67407		RP4									
v10	RP0	4.8E-05	43.20	57.16	60.55	6.8E-06	51.65	52020	v10	RP0									
	RP1	8.4E-05	40.78	46.56	48.27	1.5E-05	48.22	32298		RP1									
	RP2	1.3E-04	38.88	43.33	45.13	2.6E-05	45.78	43604		RP2									
	RP3	2.4E-04	36.28	40.22	42.08	5.4E-05	42.65	70915		RP3									
	RP4	5.6E-04	32.55	37.41	39.26	1.4E-04	38.51	67407		RP4									
v11	RP0	5.6E-05	42.51	57.03	60.01	6.8E-06	51.68	52020	v11	RP0									
	RP1	9.2E-05	40.38	46.43	48.10	1.7E-05	47.79	32298		RP1									
	RP2	1.4E-04	38.61	43.23	44.96	2.9E-05	45.38	43604		RP2									
	RP3	2.5E-04	35.97	40.03	41.89	5.9E-05	42.27	70915		RP3									
	RP4	5.9E-04	32.29	37.24	39.02	1.5E-04	38.22	67407		RP4									
v12	RP0	6.1E-05	42.16	57.15	60.12	7.0E-06	51.57	52020	v12	RP0									
	RP1	9.8E-05	40.09	46.23	47.88	1.8E-05	47.49	32298		RP1									
	RP2	1.5E-04	38.27	43.03	44.78	3.0E-05	45.17	43604		RP2									
	RP3	2.7E-04	35.73	39.91	41.74	6.1E-05	42.12	70915		RP3									
	RP4	6.2E-04	32.08	37.11	38.82	1.6E-04	38.00	67407		RP4									
v13	RP0	6.4E-05	41.92	57.14	59.91	7.1E-06	51.49	52020	v13	RP0									
	RP1	1.0E-04	39.89	46.20	47.72	1.8E-05	47.57	32298		RP1									
	RP2	1.5E-04	38.10	43.03	44.64	3.1E-05	45.15	43604		RP2									
	RP3	2.8E-04	35.59	39.85	41.64	6.2E-05	42.05	70915		RP3									
	RP4	6.3E-04	32.02	37.13	38.76	1.6E-04	37.97	67407		RP4									
v14	RP0	6.2E-05	42.06	57.36	60.17	7.2E-06	51.40	52020	v14	RP0									
	RP1	1.0E-04	39.90	46.12	47.60	1.8E-05	47.46	32298		RP1									
	RP2	1.5E-04	38.13	42.92	44.52	3.1E-05	45.10	43604		RP2									
	RP3	2.8E-04	35.51	39.82	41.46	6.4E-05	41.95	70915		RP3									
	RP4	6.5E-04	31.90	37.04	38.50	1.7E-04	37.79	67407		RP4									

Cadillac	Total kbps	Avg. Y-PSNR	Delta Y-PSNR	Atlas Gen T [s]	Video Enc T [s]	Avg. IV-PSNR	Delta IV-PSNR	Dec & Ren T [s]
RP0		37.07	12.56			43.87	15.44	
RP1	20964.7	36.42	10.82	141	11309	42.85	12.27	32298
RP2	9053.2	35.61	9.33	141	7441	41.71	10.29	43604
RP3	4093.6	34.26	7.13	141	3513	40.07	7.78	70915
RP4	1611.8	31.42	4.75	141	1728	36.98	5.40	67407
		12.56		141	5998		15.44	53556

Cadillac	Total kbps	Avg. Y-PSNR	Delta Y-PSNR	Atlas Gen T [s]	Video Enc T [s]	Avg. IV-PSNR	Delta IV-PSNR	Dec & Ren T [s]
RP0		31.17	0.58			37.47	0.86	
RP1	20964.7	31.00	0.62	141	11309	37.03	0.85	32298
RP2	9053.2	30.71	0.62	141	7441	36.41	0.82	43604
RP3	4093.6	30.36	0.54	141	3513	35.75	0.71	70915
RP4	1611.8	28.87	0.61	141	1728	33.96	0.64	67407
		0.62		141	5998		0.86	53556

In the left column there are results obtained using MIV CTC methodology, in the right – using the current INVR methodology. The reporting template is attached to this document.

2 Results

The table below includes deltaPSNR values for each sequence. Each deltaPSNR value was calculated by subtracting the average quality for RP4 from the average quality for RP1.

IV-PSNR [dB]	
delta	

A01	4.09	4.92	120%
B01	4.04	3.21	80%
B02	0.85	0.30	35%
B03	0.10	0.03	27%
C01	0.15	0.10	70%
C02	1.57	0.65	42%
J01	4.02	2.08	52%
J02	5.87	3.07	52%
J03	6.55	3.27	50%
J04	4.81	2.21	46%
W01	0.83	0.09	11%
W02	4.19	2.44	58%
D01	4.34	2.82	65%
D02	2.08	0.99	47%
D03	1.55	0.67	43%
E01	5.32	3.20	60%
E02	1.83	1.06	58%
E03	3.49	2.34	67%
L01	1.22	0.76	62%
L02	0.52	0.12	22%
L03	0.27	-0.02	-9%
AVG			35%

A01	2.05	3.09	151%
B01	1.58	0.81	51%
B02	0.38	0.08	22%
B03	0.10	0.04	37%
C01	0.13	0.08	64%
C02	0.69	0.02	3%
J01	2.99	1.31	44%
J02	5.00	2.13	43%
J03	5.81	2.32	40%
J04	3.51	0.95	27%
W01	0.58	-0.09	-15%
W02	2.53	0.91	36%
D01	3.94	2.01	51%
D02	1.31	0.24	18%
D03	0.96	0.25	26%
E01	4.17	1.97	47%
E02	1.35	0.48	35%
E03	2.19	1.04	48%
L01	0.64	0.24	38%
L02	0.31	0.01	2%
L03	0.22	-0.08	-36%
AVG			50%

The results show that for both metrics (WS-PSNR and IV-PSNR) calculation of the objective quality only for non-transmitted views flattens the curve significantly (except for A01, which is the only full-360 sequence). For two sequences, the methodology change makes the deltaPSNR value negative, meaning that the quality for RP4 is better than for RP1.

On average, RD-curve flattening is worse for WS-PSNR than for IV-PSNR.

3. No recommendations...

... so far.

4. Acknowledgement

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