Title: **Exploration Experiments on Future MIV: PUT results**

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Abstract & Recommendations

The document presents the results of exploration experiments that were conducted by PUT. The results include a description of conducted experiments and their results or crosschecks. The recommendations are:

- EE1: no change to CTC depth maps due to too small differences in posetraces.
- EE1 should be continued to test the performance of the new TMIV and IVDE,
- EE2: Perform remote expert viewing using provided posetraces.
- EE2: Fix an error in RVS 4.0 that is causing the luminance values to be above the 10-bit range.
- EE5.5: repeat the experiment if the IVDE bug will be fixed, and if proper configuration files will be provided.
- EE5.6: repeat the experiment when the bug in IVDE will be resolved.
- EE5.7: no change in the default order and keep the feature extraction on prefiltered textures.

1   Introduction

The document presents the results of EE-related experiments that were conducted by PUT. The results include full results for EE1, EE5.6, EE5.7, and partial results for EE2.1, EE2.2, and EE5.5.

2   Experiments

2.1   EE1: IVDE depth maps generation

This experiment generates a MIV anchor based on depth maps obtained with IVDE 5.0 with features extracted internally from source textures.

All results are available in reporting template included with this document. The table below shows the comparison of MIV A17 anchor with CTC depth maps and with depth maps estimated in this EE:

Mandatory content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Pixel rate [%]	Pixel rate [GP/s]	Frame rate [Hz]	Atlas encoding	Video encoding	Decoding & Rendering	MIV Anchor	EE1	Difference [%]	MIV Anchor	EE1	Difference [%]
									Runtime ratio (%)			Max delta Y-PSNR [dB]			Max delta IV-PSNR [dB]		
ClassroomVideo	A	974,7%	209,7%	193,8%	146,6%	0%	0,00	30	111,5%	162,6%	109,2%	0,99	2,65	168,9%	0,76	1,23	62,3%
Museum	B	---	---	---	467,7%	0%	0,00	30	165,4%	148,3%	120,4%	9,45	18,75	98,6%	5,35	16,59	209,9%
Fan	O	-75,2%	-70,7%	-50,5%	-47,3%	0%	0,00	30	81,5%	157,9%	142,6%	8,02	6,12	-23,6%	7,24	6,70	-7,4%
Kitchen	J	145,9%	76,1%	126,9%	61,8%	0%	0,00	30	87,6%	120,9%	118,4%	14,67	14,77	0,6%	11,19	11,75	5,0%
Painter	D	1,1%	-0,3%	4,1%	1,3%	0%	0,00	30	128,3%	99,7%	108,7%	7,94	7,50	-5,6%	5,26	5,58	6,1%
Frog	E	-20,6%	-12,6%	-12,1%	-7,9%	0%	0,00	30	109,6%	101,6%	108,3%	7,39	6,36	-13,9%	7,21	5,89	-18,3%
Carpark	P	0,6%	3,7%	3,0%	5,0%	0%	0,00	25	98,5%	72,6%	104,0%	7,05	6,99	-0,9%	5,01	4,96	-1,1%
Chess	N	---	---	---	---	0%	0,00	30	162,1%	93,0%	112,4%	13,60	28,33	108,3%	12,44	27,38	120,1%
Group	R	---	---	---	316,2%	0%	0,00	30	172,6%	77,3%	111,1%	12,89	22,09	71,4%	10,30	20,33	97,4%
MIV		---	---	---	---	**0%**	**0,00**		**124,1%**	**114,9%**	**115,0%**	**9,11**	**12,62**	**44,9%**	**7,20**	**11,16**	**52,7%**

Optional content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Pixel rate [%]	Pixel rate [GP/s]	Frame rate [Hz]	Atlas encoding	Video encoding	Decoding & Rendering	MIV Anchor	EE1	Difference [%]	MIV Anchor	EE1	Difference [%]
Fencing	L	5,0%	14,0%	-16,5%	7,4%	0%	0,00	25	108,4%	105,2%	108,8%	10,37	9,54	-8,0%	7,60	4,15	-45,4%
Hall	T	-62,3%	-48,5%	-44,8%	-39,8%	0%	0,00	25	100,0%	69,2%	93,1%	11,67	10,05	-13,8%	8,27	7,75	-6,2%
Street	U	-5,3%	-4,8%	-10,4%	-6,4%	0%	0,00	25	116,1%	95,5%	113,9%	8,48	8,52	0,5%	4,54	4,48	-1,4%
ChessPieces	Q	---	---	---	---	0%	0,00	30	123,4%	95,8%	105,6%	14,44	33,74	133,7%	15,29	34,00	122,4%
Hijack	C	---	---	---	---	0%	0,00	30	115,5%	83,4%	105,5%	7,98	21,49	169,2%	5,70	19,97	250,4%
Mirror	I	-6,0%	-13,1%	-6,2%	-13,6%	0%	0,00	30	99,2%	80,4%	104,7%	8,76	9,50	8,5%	5,23	6,10	16,6%
Cadillac	G	-0,3%	-15,0%	17,1%	-0,8%	0%	0,00	30	87,5%	101,7%	117,6%	12,08	12,93	7,0%	11,16	11,27	1,0%
MIV		---	---	---	---	**0%**	**0,00**		**107,2%**	**90,2%**	**107,0%**	**10,54**	**15,11**	**42,4%**	**8,26**	**12,53**	**48,2%**

Recommendations:

- No change to CTC depth maps due to too small differences in posetraces.
- EE1 should be continued to test the performance of the new TMIV and IVDE.

2.2 EE2: verification tests preparation

With a view of producing anchors for the verification tests, the goal of this experiment was to refine the simulation pipeline from the previous meeting cycle and have an initial performance evaluation of using the Multi-View High Efficiency Video Codec (MV-HEVC). For this experiment, only sequences that were never used for the MIV development were evaluated.

QPs chosen by PUT:

QP for geometry for MIV is computed with the formula in the MIV CTC. Tuned QPs for textures for MIV (EE2.2) are:

- H   [28, 34, 40, 46, 51]
- X   [19, 25, 31, 36, 44]
- Y   [23, 30, 37, 44, 51]
- Z   [23, 30, 37, 44, 51]

QP for geometry for MV-HEVC is computed with the formula qp[geo]=qp[tex]-10. Tuned QPs for textures for MV-HEVS (EE2.1) are:

- H   [25, 29, 34, 38, 42]
- X   [15, 20, 26, 30, 37]

- Y   [20, 26, 31, 37, 42]
- Z   [21, 27, 33, 38, 43]

Results computed by PUT:

For sequence X the calculation of PSNR for MV-HEVC-encoded data was not possible, as virtual views from RVS 4.0 had some values of luminance greater than the 10-bit range. All results are available in reporting template included with this document.
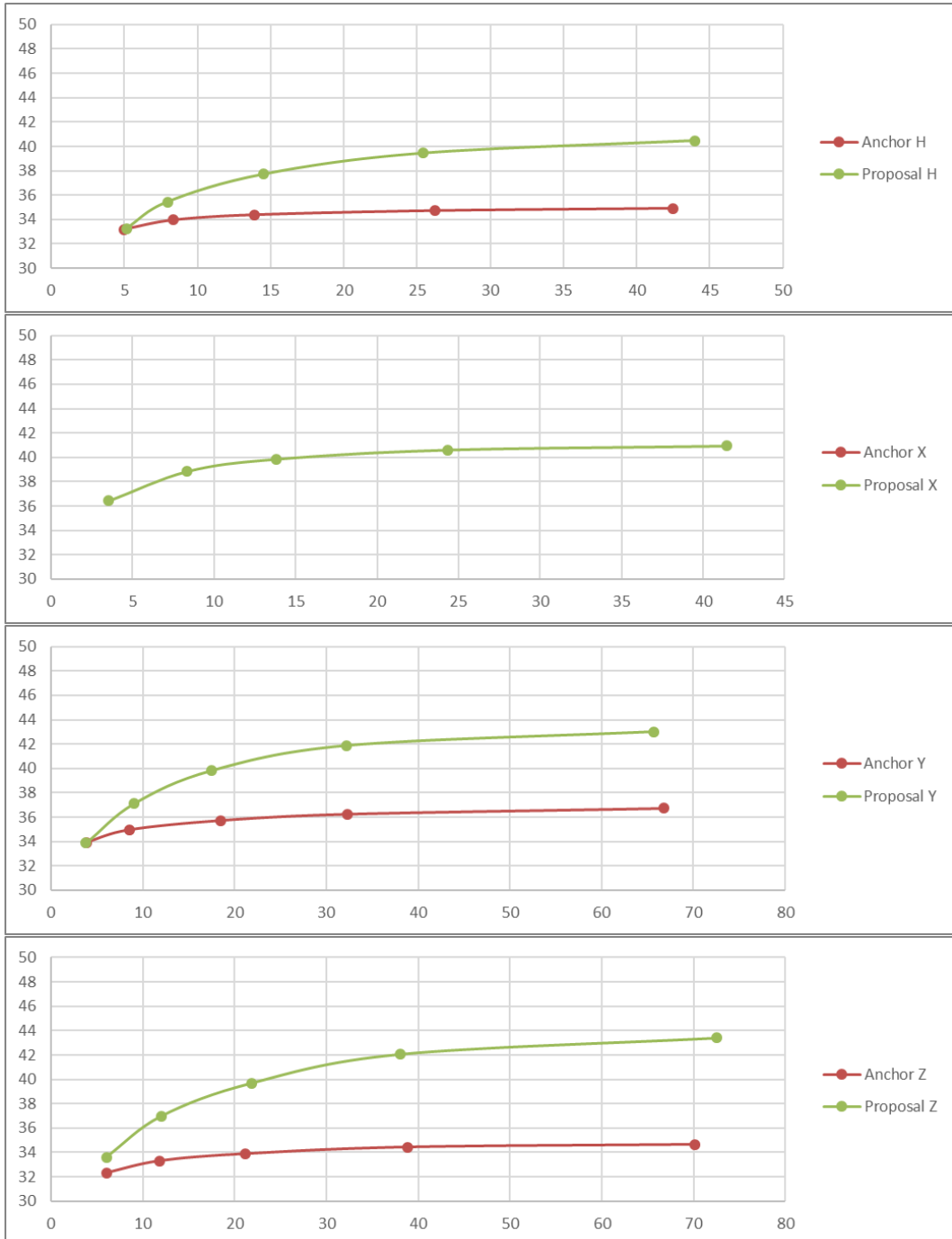
Recommendations:

- Perform remote expert viewing using provided posetraces.
- Fix an error in RVS 4.0 that is causing the luminance values to be above the 10-bit range.

2.3 EE5: Decoder-side depth estimation

All software used for EE5 was compiled using GCC 9.3.0.

2.3.1 EE5.5: Study of variants of the geometry assistance features

The final configuration files were not provided on time, so no crosscheck was available and presented results should be considered as informative only.

2.3.1.1 EE5.5-1: GA SEI for all views

Mandatory content - Proposal vs. Low/High-bitrate Anchors		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	#######	Difference [%]	MIV DSDE	#######	Difference [%]
Sequence		**Runtime ratio (%)**							**Max delta Y-PSNR [dB]**			**Max delta IV-PSNR [dB]**		
Painter	D	13.8%	10.6%	9.8%	6.9%	282.7%	101.6%	49.0%	7.15	7.99	11.7%	6.42	7.03	9.6%
Frog	E	1.1%	5.1%	5.9%	8.5%	215.3%	92.3%	13.9%	7.50	7.55	0.8%	7.31	7.65	4.6%
Kitchen	J	20.6%	19.7%	8.2%	14.9%	796.1%	104.7%	179.2%	12.74	12.65	-0.7%	12.48	11.89	-4.7%
Carpark	P	-18.5%	-7.8%	-23.9%	-13.1%	211.1%	73.9%	40.9%	10.23	9.70	-5.1%	8.19	7.38	-9.9%
Fan	O	5.3%	8.6%	0.4%	5.7%	357.5%	81.1%	13.9%	10.99	10.56	-3.9%	10.11	9.31	-7.9%
Group	R	---	---	---	---	553.1%	98.4%	28.4%	22.51	16.81	-25.3%	23.48	16.85	-28.3%
MIV		---	---	---	---	**402.6%**	**92.0%**	**54.2%**	**11.85**	**10.88**	**-3.8%**	**11.33**	**10.02**	**-6.1%**

2.3.1.2 EE5.5-2: GA SEI for views in first atlas, no recursion

Mandatory content - Proposal vs. Low/High-bitrate Anchors		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	#######	Difference [%]	MIV DSDE	#######	Difference [%]
Sequence		**Runtime ratio (%)**							**Max delta Y-PSNR [dB]**			**Max delta IV-PSNR [dB]**		
Painter	D	449.8%	169.2%	275.2%	141.4%	356.0%	107.6%	76.3%	7.15	12.79	78.9%	6.42	12.09	88.3%
Frog	E	0.8%	5.0%	8.6%	10.5%	299.4%	109.9%	57.0%	7.50	7.54	0.5%	7.31	7.66	4.7%
Kitchen	J	-19.9%	-6.1%	-24.2%	-7.8%	972.8%	120.8%	60.2%	12.74	12.08	-5.1%	12.48	10.93	-12.4%
Carpark	P	-11.6%	-2.6%	-30.2%	-18.1%	265.6%	128.2%	98.0%	10.23	9.73	-4.9%	8.19	7.18	-12.3%
Fan	O	-2.9%	3.6%	-4.2%	3.2%	440.3%	121.3%	58.1%	10.99	10.45	-4.9%	10.11	9.26	-8.4%
Group	R	---	---	---	---	659.6%	118.4%	61.3%	22.51	16.62	-26.2%	23.48	16.97	-27.7%
MIV		---	---	---	---	**498.9%**	**117.7%**	**68.5%**	**11.85**	**11.54**	**6.4%**	**11.33**	**10.68**	**5.4%**

2.3.1.3 EE5.5 – comments

- no results for EE5.5-3,
- there is a bug in IVDE, which significantly lowers the quality for SD,
- initial grid size for EE5.5-2 (32x32) was too small, thus high quantization has to be used in order to fit within the 1Mbps feature metadata limit.

2.3.1.4 Recommendations of EE5.7

We recommend repeating the experiment if the IVDE bug will be fixed, and if proper configuration files will be provided.

2.3.2 EE5.6: Study of input depth assistance in DSDE

In EE5.6, two subexperiments were conducted, in each a subset of input depth maps was sent to the decoder:

- EE5.6-1: 3 texture atlases, depth sent for views from first atlas,
- EE5.6-2: 3 texture atlases, depth sent for views from two first atlases.

2.3.2.1 EE5.6-1 (one geometry atlas)

Mandatory content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
Painter	D	15.1%	23.4%	2.3%	13.3%	342.8%	129.2%	52.5%	7.15	6.85	-4.2%	6.42	4.73	-26.2%
Frog	E	15.7%	21.0%	25.1%	26.7%	279.3%	92.8%	41.9%	7.50	7.40	-1.3%	7.31	7.75	5.9%
Kitchen	J	3.8%	0.2%	-5.4%	-3.0%	891.5%	80.2%	49.9%	12.74	11.56	-9.2%	12.48	11.22	-10.1%
Carpark	P	83.0%	70.6%	39.5%	43.3%	270.6%	93.9%	54.9%	10.23	10.05	-1.8%	8.19	7.98	-2.5%
Fan	O	34.6%	69.3%	30.3%	66.2%	443.5%	95.7%	61.2%	10.99	10.11	-8.1%	10.11	9.04	-10.6%
Group	R	---	---	---	---	627.8%	81.3%	47.3%	22.51	19.39	-13.9%	23.48	21.05	-10.3%
MIV		---	---	---	---	**475.9%**	**95.5%**	**51.3%**	**11.85**	**10.89**	**-6.4%**	**11.33**	**10.30**	**-9.0%**

Optional content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
ClassroomVideo	A	-69.3%	-39.4%	-42.2%	-23.3%	1736.0%	90.2%	41.9%	5.69	4.85	-14.8%	4.06	3.00	-26.1%
Museum	B	63.1%	30.6%	12.7%	7.9%	1755.6%	112.3%	50.2%	9.27	10.40	12.2%	6.46	7.79	20.6%
Hijack	C	---	---	---	---	753.9%	93.1%	54.4%	22.25	25.62	15.2%	20.97	24.14	15.1%
Mirror	I	15.5%	27.7%	-10.2%	17.7%	279.3%	113.5%	57.6%	13.10	12.92	-1.3%	12.96	11.47	-11.5%
Cadillac	G	3.3%	19.5%	6.1%	18.4%	562.1%	145.0%	54.1%	14.49	13.91	-4.0%	14.56	14.26	-2.0%
Fencing	L	-70.0%	-21.4%	-10.1%	13.0%	358.9%	113.1%	52.7%	12.90	12.88	-0.1%	9.18	8.95	-2.4%
Chess	N	---	---	---	---	491.7%	106.8%	61.2%	24.33	28.44	16.9%	23.08	26.90	16.6%
ChessPieces	Q	---	---	---	---	552.0%	110.9%	60.9%	27.96	30.65	9.6%	26.03	29.02	11.5%
Hall	T	---	---	601.6%	485.0%	374.2%	138.6%	48.6%	15.86	17.62	11.1%	13.16	15.80	20.1%
Street	U	5.2%	10.6%	15.1%	18.5%	265.9%	139.3%	50.1%	7.07	7.02	-0.7%	4.91	4.68	-4.6%
MIV		---	---	---	---	**713.0%**	**116.3%**	**53.2%**	**15.29**	**16.43**	**4.4%**	**13.54**	**14.60**	**3.7%**

2.3.2.2 EE5.6-2 (two geometry atlases)

Mandatory content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
Painter	D	37.9%	55.6%	20.3%	40.1%	276.8%	127.2%	32.2%	7.15	6.51	-8.9%	6.42	4.01	-37.6%
Frog	E	35.3%	44.2%	42.7%	48.7%	223.1%	122.0%	21.4%	7.50	7.48	-0.3%	7.31	7.79	6.5%
Kitchen	J	-19.8%	-8.2%	-26.7%	-11.3%	783.4%	79.0%	40.4%	12.74	10.51	-17.5%	12.48	9.58	-23.2%
Carpark	P	107.7%	109.8%	62.2%	69.9%	216.1%	122.9%	25.0%	10.23	10.37	1.4%	8.19	8.05	-1.6%
Fan	O	84.4%	151.0%	64.5%	134.3%	372.8%	123.8%	53.4%	10.99	9.95	-9.5%	10.11	8.62	-14.7%
Group	R	---	---	---	---	556.1%	81.2%	40.0%	22.51	19.15	-14.9%	23.48	20.72	-11.7%
MIV		---	---	---	---	**404.7%**	**109.3%**	**35.4%**	**11.85**	**10.66**	**-8.3%**	**11.33**	**9.80**	**-13.7%**

Optional content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
ClassroomVideo	A	-48.3%	-3.3%	-16.7%	7.7%	1443.5%	82.5%	30.7%	5.69	6.30	10.7%	4.06	4.68	15.1%
Museum	B	-11.7%	11.4%	-1.7%	13.4%	1538.5%	97.0%	43.6%	9.27	9.57	3.2%	6.46	7.09	9.7%
Hijack	C	---	---	---	---	653.6%	104.7%	44.8%	22.25	26.34	18.4%	20.97	25.13	19.9%
Mirror	I	17.8%	39.0%	-12.7%	22.8%	241.0%	125.5%	41.2%	13.10	12.65	-3.4%	12.96	11.08	-14.6%
Cadillac	G	9.7%	40.4%	4.8%	33.9%	476.8%	155.4%	38.3%	14.49	13.45	-7.2%	14.56	13.59	-6.7%
Fencing	L	-58.9%	1.8%	5.4%	38.3%	273.1%	108.8%	12.9%	12.90	12.89	0.0%	9.18	9.02	-1.7%
Chess	N	---	---	---	---	408.6%	100.8%	57.6%	24.33	26.93	10.7%	23.08	26.10	13.1%
ChessPieces	Q	---	142.2%	---	261.1%	433.2%	130.5%	66.2%	27.96	29.04	3.9%	26.03	27.76	6.6%
Hall	T	820.7%	167.2%	-14.0%	7.0%	304.7%	208.5%	21.1%	15.86	16.18	2.0%	13.16	13.11	-0.4%
Street	U	20.3%	26.9%	27.1%	33.8%	234.2%	163.8%	50.5%	7.07	7.04	-0.4%	4.91	4.71	-4.0%
MIV		---	---	---	---	**600.7%**	**127.7%**	**40.7%**	**15.29**	**16.04**	**3.8%**	**13.54**	**14.23**	**3.7%**

2.3.2.3 One geometry atlas vs. two geometry atlases

Mandatory content - Proposal vs. Low/High-bitrate Anchors | **Runtime ratio (%)** | **Max delta Y-PSNR [dB]** | **Max delta IV-PSNR [dB]**

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
Painter	D	12.3%	19.2%	9.0%	16.6%	80.7%	90.8%	61.3%	6.85	6.51	-4.9%	4.73	4.01	-15.4%
Frog	E	16.7%	19.0%	14.1%	17.3%	79.9%	130.0%	51.1%	7.40	7.48	1.0%	7.75	7.79	0.5%
Kitchen	J	-37.6%	-25.8%	-37.6%	-26.7%	87.9%	77.0%	81.0%	11.56	10.51	-9.1%	11.22	9.58	-14.6%
Carpark	P	17.4%	22.4%	15.6%	19.0%	79.9%	128.6%	45.5%	10.05	10.37	3.2%	7.98	8.05	0.9%
Fan	O	34.6%	46.5%	25.0%	39.3%	84.0%	127.4%	87.3%	10.11	9.95	-1.6%	9.04	8.62	-4.6%
Group	R	-75.3%	-70.0%	-72.6%	-62.2%	88.6%	76.1%	84.5%	19.39	19.15	-1.2%	21.05	20.72	-1.6%
MIV		**-5.3%**	**1.9%**	**-7.7%**	**0.5%**	**83.5%**	**105.0%**	**68.4%**	**10.89**	**10.66**	**-2.1%**	**10.30**	**9.80**	**-5.8%**

Optional content - Proposal vs. Low/High-bitrate Anchors

Sequence		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
ClassroomVideo	A	37.9%	22.3%	11.2%	10.8%	83.1%	71.9%	73.2%	4.85	6.30	29.9%	3.00	4.68	55.7%
Museum	B	-47.7%	-27.8%	-28.6%	-15.1%	87.6%	71.5%	86.8%	10.40	9.57	-8.0%	7.79	7.09	-9.0%
Hijack	C	---	---	---	---	86.7%	89.7%	82.3%	25.62	26.34	2.8%	24.14	25.13	4.1%
Mirror	I	2.8%	9.1%	-0.4%	4.5%	86.3%	108.7%	71.4%	12.92	12.65	-2.1%	11.47	11.08	-3.4%
Cadillac	G	2.9%	16.0%	-3.1%	12.3%	84.8%	105.4%	70.8%	13.91	13.45	-3.4%	14.26	13.59	-4.7%
Fencing	L	32.5%	27.7%	15.7%	21.6%	76.1%	95.2%	24.4%	12.88	12.89	0.1%	8.95	9.02	0.7%
Chess	N	---	---	---	---	83.1%	81.5%	94.1%	28.44	26.93	-5.3%	26.90	26.10	-3.0%
ChessPieces	Q	---	---	---	---	78.5%	102.3%	108.8%	30.65	29.04	-5.2%	29.02	27.76	-4.3%
Hall	T	---	---	---	---	81.4%	149.1%	43.5%	17.62	16.18	-8.2%	15.80	13.11	-17.1%
Street	U	13.6%	14.6%	10.2%	12.6%	88.1%	115.8%	100.7%	7.02	7.04	0.3%	4.68	4.71	0.7%
MIV		**---**	**---**	**---**	**---**	**83.6%**	**99.1%**	**75.6%**	**16.43**	**16.04**	**0.1%**	**14.60**	**14.23**	**2.0%**

2.3.2.4 EE5.6 – comments

- the "AutomaticDepthRange" parameter has to be set to false when we send input depth maps with already known ZRange,
- the total number of atlases in EE5.6-2 is five (3 attribute + 2 geometry atlases), however, the geometry atlases have reduced resolution, so they could be potentially packed,
- sending of input depth maps allows to significantly reduce the decoding time (by 50% when 1 geometry atlas is available, and by 60% when two atlases are sent),
- for a majority of perspective content, the objective BD rates are worse because of similar quality and increase of the bitrate,
- subjectively, the posetraces for the approach with input depth assistance are more stable and consistent, than for the G17 anchor,
- for SN, SC, SQ, the bug in IVDE reduces the efficiency of the approach with input depth assistance,
- the same bug probably lowers the quality for SB, however, the current results are already much better than the G17 anchor,
- approach with two geometry atlases seems to be more efficient when there are more views, or the cameras captured the scene from very different angles (i.e., SR).

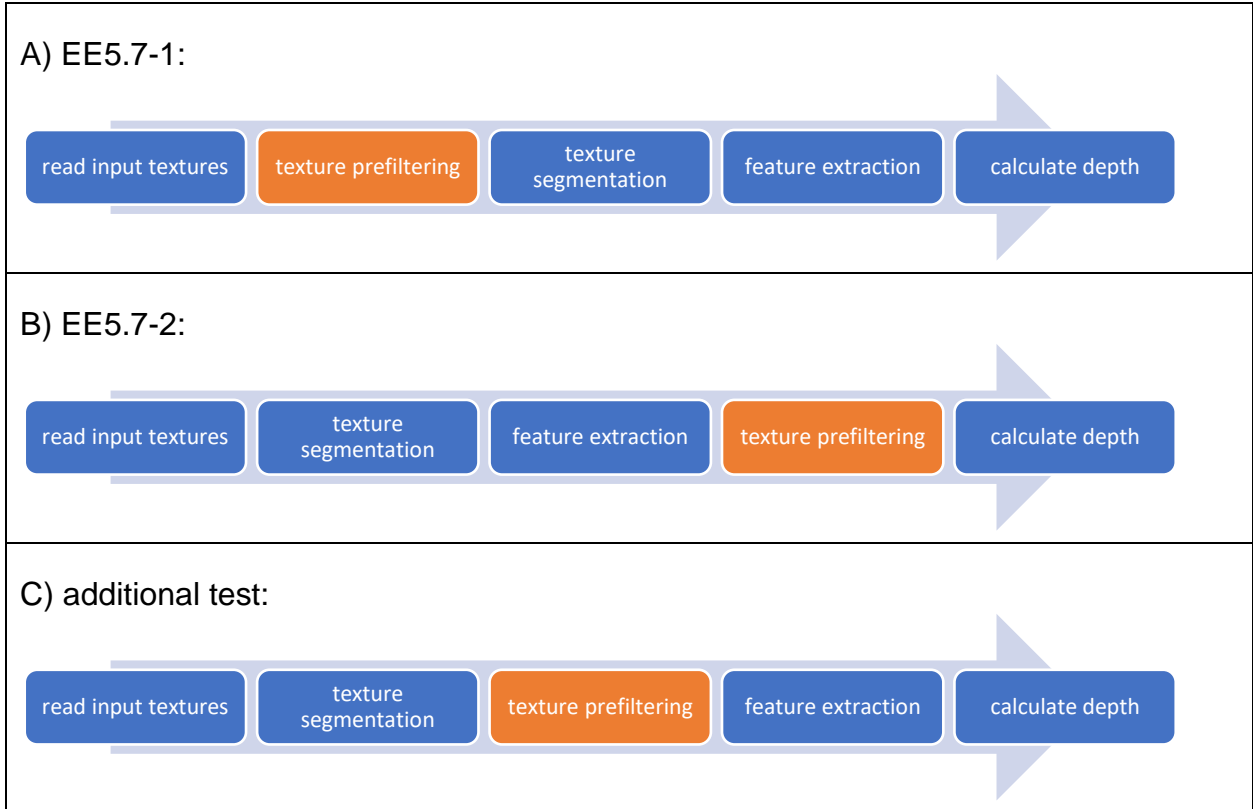### 2.3.2.5 Recommendations of EE5.6

We recommend repeating the experiment when the bug in IVDE will be resolved.

2.3.3 EE5.7: Study of dependency between texture prefiltering and feature extraction

In EE5.7, two different orders of texture prefiltering and feature extraction were tested:

- EE5.7-1: feature extraction on prefiltered textures (Fig. A),
- EE5.7-2: filtering of textures after feature extraction (Fig. B).

Additionally, we have tested the third order, where texture prefiltering is before feature extraction, but after segmentation (Fig. C).

A) EE5.7-1:
read input textures → texture prefiltering → texture segmentation → feature extraction → calculate depth

B) EE5.7-2:
read input textures → texture segmentation → feature extraction → texture prefiltering → calculate depth

C) additional test:
read input textures → texture segmentation → texture prefiltering → feature extraction → calculate depth

2.3.3.1 EE5.7-1

This is the default configuration used in the G17 anchor.

2.3.3.2 EE5.7-2

In this subexperiment, the default TMIV11.0 and IVDE5.0 were used. The IVDE configuration file was changed by adding one parameter:

"TexturePrefilteringOrder": 3

Mandatory content - Proposal vs. Low/High-bitrate Anchors					Runtime ratio (%)			Max delta Y-PSNR [dB]			Max delta IV-PSNR [dB]		
Sequence	High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
Painter D	-2.1%	-0.8%	-1.2%	-0.5%	97.9%	103.6%	80.1%	7.15	6.92	-3.2%	6.42	6.49	1.1%
Frog E	-0.0%	-0.0%	0.1%	0.2%	105.9%	94.4%	82.7%	7.50	7.47	-0.4%	7.31	7.29	-0.4%
Kitchen J	-1.8%	-2.2%	-0.3%	-1.6%	133.1%	111.1%	99.5%	12.74	13.06	2.5%	12.48	13.07	4.8%
Carpark P	2.2%	-0.4%	4.1%	1.8%	71.2%	92.3%	88.3%	10.23	10.21	-0.2%	8.19	8.26	0.9%
Fan O	0.5%	-0.0%	4.7%	2.6%	74.2%	115.4%	106.1%	10.99	10.84	-1.4%	10.11	10.21	1.0%
Group R	-22.2%	-15.7%	-23.0%	-13.5%	96.8%	110.3%	81.1%	22.51	22.45	-0.3%	23.48	23.39	-0.4%
MIV	**-3.9%**	**-3.2%**	**-2.6%**	**-1.8%**	**96.5%**	**104.5%**	**89.6%**	**11.85**	**11.82**	**-0.5%**	**11.33**	**11.45**	**1.2%**

Comments:

- for 5 of 6 sequences, the differences are negligible and we cannot say, that one approach is better than the other,
- for SR we can see a huge BD difference both for PSNR and IV-PSNR, and the curve for EE5.7-2 is noticeably higher, than for the G17 anchor:
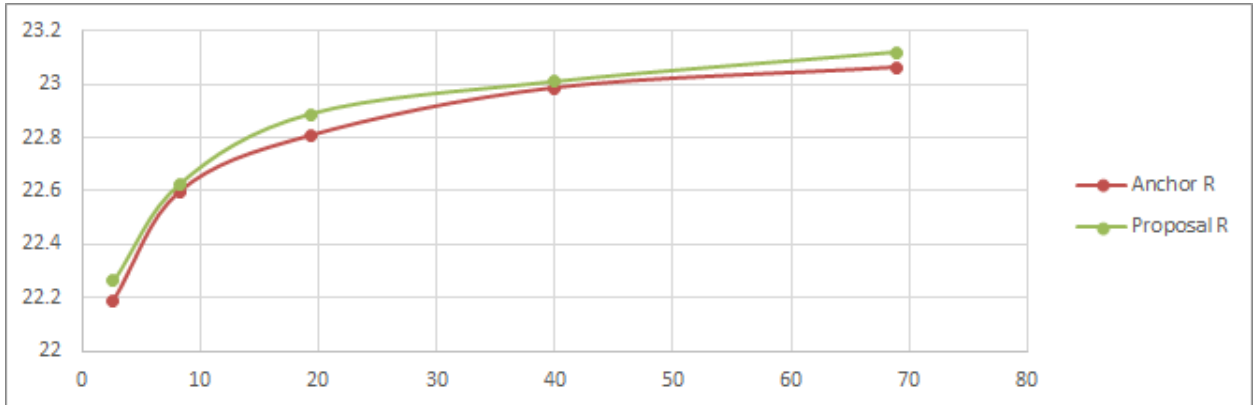
- nevertheless, we cannot say, that the subjective quality for SR is better, as the quality for some views grew up from 17.3 to 17.6, which is still ridiculously low; the synthesized views look different, but equally bad:

SR, v2, EE5.7-1 (G17 anchor), 17.3 dB:

SR, v2, EE5.7-2, 17.6 dB:

2.3.3.3 Additional test

In this test, we used the same configuration, as in EE5.7-2, but the "TexturePrefilteringOrder" was set to 2.

Tested approach vs. G17 anchor:

Mandatory content - Proposal vs. Low/High-bitrate Anchors		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Runtime ratio (%)			Max delta Y-PSNR [dB]			Max delta IV-PSNR [dB]		
Sequence						Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	#######	Difference [%]	MIV DSDE	#######	Difference [%]
Painter	D	-1.4%	-0.6%	-0.5%	-0.3%	136.7%	118.5%	95.3%	7.15	7.06	-1.3%	6.42	6.56	2.3%
Frog	E	0.8%	0.4%	0.6%	0.4%	107.1%	116.4%	96.0%	7.50	7.48	-0.2%	7.31	7.29	-0.3%
Kitchen	J	-1.8%	-2.2%	-0.3%	-1.6%	134.2%	104.3%	95.0%	12.74	13.06	2.5%	12.48	13.07	4.8%
Carpark	P	5.6%	1.4%	5.1%	2.6%	103.4%	97.7%	90.5%	10.23	10.22	-0.1%	8.19	8.25	0.8%
Fan	O	1.9%	0.6%	5.1%	2.7%	88.1%	104.3%	105.0%	10.99	10.84	-1.4%	10.11	10.19	0.8%
Group	R	-21.3%	-14.8%	-22.6%	-13.2%	132.0%	113.9%	97.1%	22.51	22.44	-0.3%	23.48	23.39	-0.4%
MIV		-2.7%	-2.5%	-2.1%	-1.6%	116.9%	109.2%	96.5%	11.85	11.85	-0.1%	11.33	11.46	1.3%

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EE5.7-2 vs. tested approach:

Mandatory content - Proposal vs. Low/High-bitrate Anchors		High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Atlas encoding	Video encoding	Decoding & Rendering	MIV DSDE	######	Difference [%]	MIV DSDE	######	Difference [%]
Sequence						Runtime ratio (%)			Max delta Y-PSNR [dB]			Max delta IV-PSNR [dB]		
Painter	D	-0.8%	-0.3%	-0.7%	-0.2%	71.6%	87.4%	84.1%	7.06	6.92	-2.0%	6.56	6.49	-1.1%
Frog	E	-0.8%	-0.4%	-0.5%	-0.2%	98.9%	81.1%	86.2%	7.48	7.47	-0.2%	7.29	7.29	-0.1%
Kitchen	J	-0.0%	-0.0%	-0.0%	-0.0%	99.1%	106.5%	104.7%	13.06	13.06	0.0%	13.07	13.07	0.0%
Carpark	P	-3.3%	-2.0%	-1.0%	-0.8%	68.9%	94.5%	97.6%	10.22	10.21	-0.1%	8.25	8.26	0.1%
Fan	O	-1.4%	-0.6%	-0.4%	-0.2%	84.3%	110.7%	101.1%	10.84	10.84	0.0%	10.19	10.21	0.2%
Group	R	-1.2%	-1.0%	-0.5%	-0.4%	73.4%	96.8%	83.5%	22.44	22.45	0.0%	23.39	23.39	0.0%
MIV		-1.3%	-0.7%	-0.5%	-0.3%	82.7%	96.2%	92.9%	11.85	11.82	-0.4%	11.46	11.45	-0.2%

Comments:

- tested approach is slightly worse, than the EE5.7-2 approach,
- the differences are negligible except for SR, where there is a similar case, as for EE5.7-2.

2.3.3.4 Recommendations of EE5.7

We recommend to not change the default order and stay with feature extraction on prefiltered textures.

Acknowledgement