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Source	**Poznań University of Technology (PUT), Poznań, Poland** **Electronics and Telecommunications Research Institute (ETRI), Daejeon, Republic of Korea**
Status	**Input**
Title	**Immersive Video CE3-related: Spatio-temporal patch redundancy removal**
Author	Adrian Dziembowski*, Dawid Mieloch*, Adam Grzelka*, Jakub Stankowski*, Marek Domański*, Gwangsoon Lee** * – Poznań University of Technology, ** – Electronics and Telecommunications Research Institute

1 Introduction

This document presents a technical description of the PUT/ETRI core-experiment-related proposal on the atlas preparation (Immersive Video CE-3 [1]).

2 Overview of the proposed technique

Atlas preparation algorithm in TMIV still has one major flaw – there is a lot of redundant parts of input views in the atlases. The same information is copied within numerous patches, thus repeated many times. There are two reasons of that redundancy:

1. spatial – patches are filled by copying information in the entire bounding box of the cluster,
2. temporal – size and shape of each patch is aggregated for the whole GOP.

The proposed approach reduces influence of both issues, significantly reducing data redundancy, thus the size of the final bitstream. Here, the performance of the proposed temporal redundancy and patch splitting techniques presented in proposals [2] and [3] will be presented together.

3 Experimental results

The results of the proposed enhancements are presented in the table below.

As the results show, use of the proposed patch splitting and temporal redundancy removal techniques together merges the advantages of both techniques. Therefore, both the pixel rate reduction and decreased BD-rate for IV-PSNR can be seen.

Test class	Sequence	Anchor (ff)	High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	Max delta Y-PSNR	High-BR BD rate VMAF	Low-BR BD rate VMAF	High-BR BD rate MS-SSIM	Low-BR BD rate MS-SSIM	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Pixel rate ratio
CG	ClassroomVideo	AA97 (MIV)	6.7%	9.5%	4.42	4.2%	9.5%	1.3%	6.4%	-9.0%	-0.9%	0.00%
	TechnicolorMuseum	BA97 (MIV)	1.5%	1.0%	12.95	-0.7%	-1.8%	-2.6%	-3.6%	-15.4%	-13.8%	-13.51%
	TechnicolorHijack	CA97 (MIV)	0.1%	8.9%	12.14	-5.7%	-1.0%	-2.0%	7.6%	-8.9%	2.3%	-20.00%
	OrangeKitchen	JA97 (MIV)	-0.1%	-2.5%	14.25	-4.4%	-6.1%	-4.0%	-4.9%	-9.3%	-8.2%	-11.11%
		MIV	2.1%	4.2%	14.25	-1.6%	0.2%	-1.8%	1.4%	-10.6%	-5.1%	-19.98%
		All anchors	2.1%	4.2%	14.25	-1.6%	0.2%	-1.8%	1.4%	-10.6%	-5.1%	-19.98%

NC	TechnicolorPainter	DA97 (MIV)	-4.8%	1.2%	6.71	-3.1%	0.6%	-9.9%	-1.8%	-12.6%	-5.3%	0.00%
	IntelFrog	EA97 (MIV)	37.1%	1.1%	10.95	1.4%	-14.8%	7.8%	-12.3%	34.1%	-0.6%	0.00%
	PoznanFencing	LA97 (MIV)	90.0%	84.3%	14.07	142.2%	91.5%	342.7%	137.5%	34.5%	42.4%	0.00%
		MIV	40.8%	28.9%	14.07	46.8%	25.8%	113.6%	41.1%	18.7%	12.2%	0.00%
		All anchors	40.8%	28.9%	14.07	46.8%	25.8%	113.6%	41.1%	18.7%	12.2%	0.00%

Test class	Sequence	Anchor (ff)	High-BR BD rate Y-PSNR	Low-BR BD rate Y-PSNR	Max delta Y-PSNR	High-BR BD rate VMAF	Low-BR BD rate VMAF	High-BR BD rate MS-SSIM	Low-BR BD rate MS-SSIM	High-BR BD rate IV-PSNR	Low-BR BD rate IV-PSNR	Pixel rate ratio
All		MIV	18.6%	14.8%	10.79	19.1%	11.1%	47.6%	18.4%	1.9%	2.3%	-6.71%
		All anchors	18.6%	14.8%	10.79	19.1%	11.1%	47.6%	18.4%	1.9%	2.3%	-6.71%

4 Acknowledgement

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5 Recommendations

We recommend the group to focus on the quality of depth maps for natural content, as the SD sequence shows that the further decrease of BD-rate can be achieved even for estimated (not generated) depth maps.

Considering much better results than for TMIV 3.0 anchor, we suggest to include our techniques into TMIV 3.0.

6 References

[1] Renaud Doré, “Description of Immersive Video Core Experiments 3 (Atlas preparation)”, ISO/IEC JTC1/SC29/WG11 MPEG/N18934, October 2019, Geneva, CH.

[2] Adrian Dziembowski, Dawid Mieloch, Adam Grzelka, Jakub Stankowski, Marek Domański, Gwangsoon Lee, “Immersive Video CE3.1: Patch splitting”, ISO/IEC JTC1/SC29/WG11 MPEG/M51602, October 2019, Geneva, CH.

[3] Adrian Dziembowski, Dawid Mieloch, Adam Grzelka, Jakub Stankowski, Marek Domański, Gwangsoon Lee, “Immersive Video CE3.1: Patch splitting”, ISO/IEC JTC1/SC29/WG11 MPEG/M51632, October 2019, Geneva, CH.