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Title: CE13.6 report on nearest neighbour search order

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Abstract

This document reports on the performance of the proposed neighbour search order used in constructing levels of detail for attribute coding as part of core experiment 13.6 [1, N18905].

Introduction

The mandate of the core experiment is to evaluate the LoD construction method [2] and to —

- examine the coding efficiency of the proposed method.

- examine the complexity of the proposed method.

Implementation

The implementation is available in the `mpeg128/ce13.6/nn-search-order` branch of the CE repository and is split into two parts. First the neighbour update function is refactored to remove duplicate code. This is non-normative and serves to make the second part, the search order change, more readable.

The change to the search order in LoD construction is such that, neighbours in subsequent LoDs with the same distance from the current point are ordered first by direction, neighbours in the same LoD with the same distance from the current point are searched in forward order, and that neighbours in subsequent LoDs have a higher priority than neighbours in the same LoD.

Results

Table 1 shows the performance of the proposed search order change compared to the TMC13v8 anchor [3]. Since the change includes an aspect related to refactoring, the effects of this compared to the same anchor is shown in Table 2.

Table 1 – Performance of the proposed search order compared to TMC13v8.0

Condition	Class	BPP Ratio [%]			BD-Rate [Δ%]						Avg. of ratio maxrssk [%]		Ratio of avg. runtime [%]	
		Geometry	Colour	Refl	D1	D2	Y	Cb	Cr	R	Encoder	Decoder	Encoder	Decoder
C1_ai	cat1-A						−0.0	0.0	0.0		100	100	99	98
C1_ai	cat3-fused						0.0	−0.0	−0.0	−0.0	100	100	99	100
C1_ai	cat3-frame									0.0	100	100	91	90
C1_ai	overall						−0.0	0.0	0.0	0.0	100	100	97	96
C2_ai	cat1-A				0.0	0.0	0.1	0.2	−0.2		100	100	100	92
C2_ai	cat1-B				0.0	0.0					100	100	97	100
C2_ai	cat3-fused				0.0	0.0	0.0	−0.0	0.0	−0.0	100	100	104	97
C2_ai	cat3-frame				0.0	0.0				0.0	100	100	98	93
C2_ai	overall				0.0	0.0	0.1!	0.2!	−0.1!	0.0	100	100	99	96
CW_ai	cat1-A	100.0	100.0								100	100	99	99
CW_ai	cat1-B	100.0									100	100	97	97
CW_ai	cat3-fused	100.0	100.0	100.0							100	100	91	94
CW_ai	cat3-frame	100.0		100.0							100	100	87	87
CW_ai	overall	100.0	100.0!	100.0							100	100	96	96
CY_ai	cat1-A						0.0	0.0	0.0		100	100	99	96
CY_ai	cat3-fused						0.0	0.0	0.0	0.0	100	100	94	97
CY_ai	cat3-frame									0.0	100	100	100	100
CY_ai	overall						0.0	0.0	0.0	0.0	100	100	99	97

NOTE — Condition CY metrics reported using Hausdorff PSNR.

Table 2 – Effect of refactoring compared to TMC13v8.0

Condition	Class	BPP Ratio [%]			BD-Rate [Δ%]						Avg. of ratio maxrssk [%]		Ratio of avg. runtime [%]	
		Geometry	Colour	Refl	D1	D2	Y	Cb	Cr	R	Encoder	Decoder	Encoder	Decoder
C1_ai	cat1-A						0.0	0.0	0.0		100	100	100	100
C1_ai	cat3-fused						0.0	0.0	0.0	0.0	100	100	100	100
C1_ai	cat3-frame									0.0	100	100	97	96
C1_ai	overall						0.0	0.0	0.0	0.0	100	100	99	99
C2_ai	cat1-A				0.0	0.0	0.0	0.0	0.0		100	100	102	100
C2_ai	cat1-B				0.0	0.0					100	100	98	97
C2_ai	cat3-fused				0.0	0.0	0.0	0.0	0.0	0.0	100	100	106	102
C2_ai	cat3-frame				0.0	0.0				0.0	100	100	98	99
C2_ai	overall				0.0	0.0	0.0!	0.0!	0.0!	0.0	100	100	100	99
CW_ai	cat1-A	100.0	100.0								100	100	100	105
CW_ai	cat1-B	100.0									100	100	98	100
CW_ai	cat3-fused	100.0	100.0	100.0							100	100	103	95
CW_ai	cat3-frame	100.0		100.0							100	100	93	93
CW_ai	overall	100.0	100.0!	100.0							100	100	98	101
CY_ai	cat1-A						0.0	0.0	0.0		100	100	100	99
CY_ai	cat3-fused						0.0	0.0	0.0	0.0	100	100	96	97
CY_ai	cat3-frame									0.0	100	100	106	107
CY_ai	overall						0.0	0.0	0.0	0.0	100	100	101	101

NOTE — Condition CY metrics reported using Hausdorff PSNR.

References

[1] 3DG, "CE4FE 13.6 Attribute LOD generation," ISO/IEC JTC1/SC29/WG11, 128th meeting, Geneva, Tech. Rep. w18905, Oct. 2019.

[2] Z. Gao, D. Flynn, A. Tourapis, and K. Mammou, "[G-PCC][New proposal] Improved implementation of the Prediction and Lifting schemes," ISO/IEC JTC1/SC29/WG11, 128th meeting, Geneva, Tech. Rep. m51010, Oct. 2019.

[3] 3DG, "Common Test Conditions for PCC," ISO/IEC JTC1/SC29/WG11, 128th meeting, Geneva, Tech. Rep. w18883, Oct. 2019.

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