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**ISO/IEC JTC 1/SC 29/WG 11**

**CODING OF MOVING PICTURES AND AUDIO**

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**Alpbach, AUT – April 2020**

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**Description of Core Experiment 13.33 on coding of transform coefficients**

# Abstract

This document provides a description of G-PCC Core Experiment (CE) 13.33 on coding of transform coefficients.

# Introduction

The goal of CE 13.33 is to investigate the performances of the coding schemes for coding of transform coefficients as presented in m52986 with respect to the anchor method from m53337 adopted at the 130th meeting. In addition, the run-length coding scheme from mm52986 is studied in this CE.

# Information about related proposals

* 1. ***m53337: Report on coding of transform coefficients [2]***

In this report, the results of CE13.33 on simplifying the attribute transform-coefficient coding as proposed in m52720 are reported. The proposed scheme simplifies coefficients coding by replacing the dictionary-based parsing process that needs regular updates of multiple lookup tables with a symbol-grouping scheme and applies to coding of Predicting-Transform, Lifting-Transform, and RAHT-Transform coefficients. It also provides coding gains for all testing conditions consistently and achieves average lossy BDR-savings of up to 1% (C2, Lifting) and lossless bitrate reduction of up to 2.5% (CW, Predict, reflectance).

* 1. ***m52986: Improving entropy coding of RAHT coefficients [3]***

It is proposed to improve the overall compression performance of RAHT by making the lossless entropy coding of the quantized coefficients more efficient. Three improvements are proposed:

1. Modifying the run length coding for the zero quantized coefficients by adding two steps of Truncated Rice coding and expGolomb coding,
2. Bypassing the sign of quantized coefficients,
3. Removing the dictionary for coding unsigned quantized coefficients, absorbed by an already present expGolomb coding.
   1. ***m53678: Coding of significant attribute coefficients[4]***

For the purpose of reducing the number of arithmetically coded bins (and increasing the relative ratio of bypass coded bins), the proposed bi-state run-length coding replaces the existing unary coded zero-run-length coding of significant coefficient values. The proposed method encodes zero-runs and non-zero-runs using a parameterised sub-exponential code.  The parameterisation depends upon the run type.  Contextualisation is based upon the run type and the prefix bits of the code, suffix bits are bypass coded.

# Experimental description

In this CE, the proposed transform coefficient coding schemes will be evaluated in terms of its coding efficiency and implementation aspects.

## Mandates

1. To Study and evaluate the compression performance of the related methods described in Sections 2.1 and 2.2.

More specifically, the following methods will be compared in terms of compression efficiency and complexity/throughput aspects.

- The anchor method of Section 2.1 as shown in Figure 2 and possibly its optimized version considering the sign-bypass coding adopted at the 130th meeting.

- One of the proposed methods 0 through 2 of Section 2.2 as shown in Figures 3 through 5 and possibly its optimized version (It was mentioned in the revised version of the input contribution that Method 2 is the preferred method).

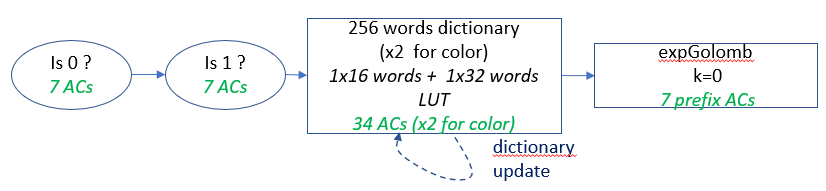


Figure 1. TMC13 old anchor method [5] (replaced by [1] at the 130th meeting)

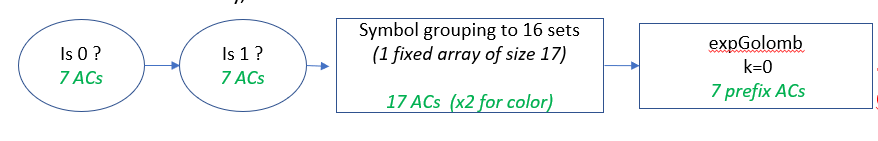


Figure 2. TMC13 anchor method [1] (adopted at 130th meeting)

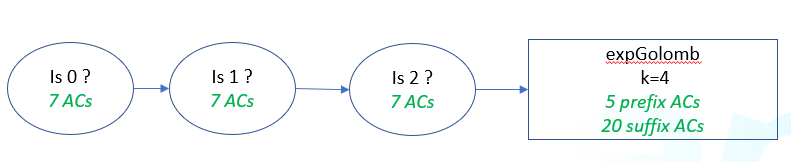


Figure 3. Proposed method-0 of [3] (proposed at 130th meeting)

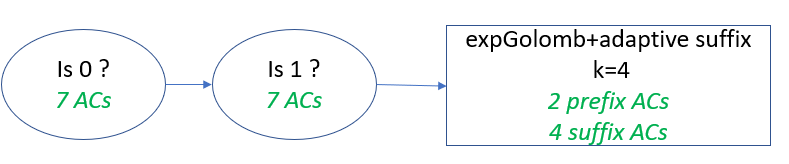


Figure 4. Proposed method-1 of [3] (proposed at 130th meeting)

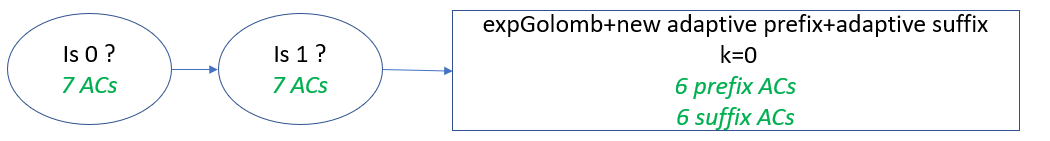


Figure 5. Proposed method-2 of [3] (proposed at 130th meeting)

2. To study the harmonization of TMC13 anchor method [1] and one of the Proposed methods-0 through 2 of [3] if possible.

3. To study the bi-state run-length coding scheme [4]

4. To study the combination of the bi-state coding from [4] with the run binarisation proposed in [3]

## Information for conducting tests

### Participants

| **Name** | **Company** | **E-mail address** | **Type** |
| --- | --- | --- | --- |
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|  |  |  |  |

### Software

TMC13v10 shall be used for these experiments. The proposed tools shall be implemented on top of TMC13v10.

### Test configurations

Parameters and configurations for TMC13v10 software will be provided by the proponent.

### Evaluation Method

The point cloud test material will be tested under the following conditions of the CTC [7]:

Predict-Lifting + Octree

* C1 Lossless Geometry - Lossy Attributes
* C2 Lossy Geometry - Lossy Attributes
* CY Lossless Geometry - Nearlossless Attributes
* CW Lossless Geometry - Lossless Attributes

RAHT + Octree

* C1 Lossless Geometry - Lossy Attributes
* C2 Lossy Geometry - Lossy Attributes

(Optional Tests) Predict-Lifting + Trisoup

* C2 Lossy Geometry - Lossy Attributes

(Optional Tests) RAHT + Trisoup

* C2 Lossy Geometry - Lossy Attributes

## CE.13.33 Coordinators

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# Timeline:

* **2020-05-08**: Expected date for TMC13v10 release;
* **2020-05-29**:Source code and results to cross-checkers;
* **2020-06-06:** Preliminary feedback from cross-checkers;
* **2020-07-01**: MPEG document upload deadline.

# References

1. Alphabet-partition coding of transform coefficients, ISO/IEC JTC1/SC29 WG11 m52720, Brussels, BE, January 2020.
2. [CE13.33] Report on coding of transform coefficients, ISO/IEC JTC1/SC29 WG11 m53337, Alpbach, AUT, April 2020.
3. Improving entropy coding of RAHT coefficients, ISO/IEC JTC1/SC29 WG11 m52986, Alpbach, AUT, April 2020.
4. Coding of significant attribute coefficients, ISO/IEC JTC1/SC29 WG11 m53678, Alpbach, AUT, April 2020.
5. G-PCC codec description, ISO/IEC JTC1/SC29 WG11 w19091, Brussels, BE, January 2020.
6. G-PCC Test Model v10, ISO/IEC JTC1/SC29/WG11 w19323, Alpbach, AUT, April 2020.
7. Common Test Conditions for PCC, ISO/IEC JTC1/SC29 WG11 w19324, Alpbach, AUT, April 2020.