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**Email of convenor: leonardo@chiariglione.org**

**Committee URL: mpeg.chiariglione.org**

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| **Source:** | **3DG** |
| **Status :** | **Draft** |
| **Title:** | **Description of EE13.5 for G-PCC: on Region-wise Quantization Control on Attribute Coding** |
| **Author:** | **Noritaka Iguchi (Panasonic)** |

# Abstract

This document provides a description of PCC Exploration Experiments (EE) 13.5 on Region-wise Quantization control for attribute coding.

# Introduction

In the 3D point cloud, the required visual importance and quality is different depending on the 3D region. For example, the face region of a human has higher importance and thus required better quality.

m49626 proposed region-wise quantization control in Attribute coding which changes the quantization parameter based on the geometry position in a slice.

It can keep the compression performance compared to a slice base QP Control because the attribute prediction structure will not be changed.



Figure 1 Concept of Region-wise QP control

# Mandates

A mandate of this EE13.5 is to evaluate the Region-wise Quantization control in single slice implementation for attributes coding [1].

Region-wise control on Lifting/Predicting coding was already evaluated and adopted [2]. So in this EE, proposed method on RAHT coding is evaluated.

# Participants

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| --- | --- | --- | --- |
| ***Participant*** | ***Contact*** | ***Email*** | ***Type*** |
| Panasonic | Noritaka Iguchi | iguchi.noritaka@jp.panasonic.com | P |
| Sony | Satoru Kuma | Satoru.Kuma@sony.com | C |

(P=proponent, C=crosss checker)

# Test Model, Anchors and CTC

The latest G-PCC reference software TMC13v8 [3] will be used as the anchor for this EE result gathering and comparison purposes.

## Test Conditions

Subjective quality test will be run on selected 3D Point Cloud content available in common test condition.

Tests will be also performed using the Category 1 and Category 3 on common test conditions [4] to check on conformity.

## Process of 3D Region Using QP Control

In 3D-Region QP control method, the different attribute QP value is applied to specific region. Figure 2 shows the part of process of encoder. At first, slice QP is pre-determined. Next, the region where QP value should be changed and its target QP are determined, and the differential values of QP are calculated.

Before attribute coding, The QP value for each point is determined by using geometry as following,

* If a 3D point cloud is within the box region, then Delta QP value will be added on the slice QP to get the effective QP for that point.
* Otherwise slice QP will be the effective QP.

After that, the attribute value of each point is processed with Lifting / RAHT along with Delta QP value.

Compare to tile and slice based QP tuning, region based QP tuning will not break the continuity of the 3D point cloud referencing. This makes a more efficient predicting algorithm and encoding performance improved. If there are multiple regions, this process is executed for each area.

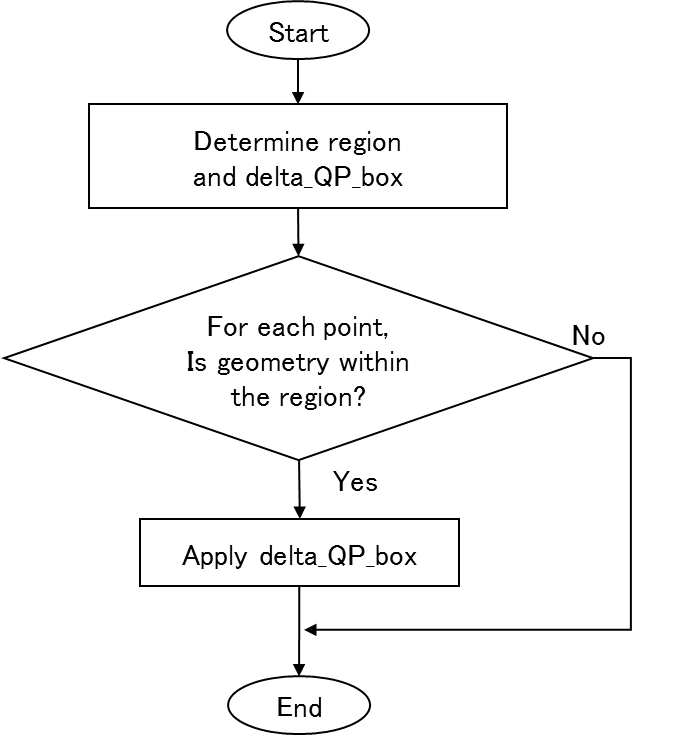


Figure 2 Diagram of proposed method

For Predicting/Lifting, the residual attribute value of each 3D point is calculated by using prediction method, and then it is quantized with QP value.

For RAHT, the transform function takes two nodes and divides the energy level of the attributes information into high or low frequency. The higher frequency is quantized and coded while the lower frequency is propagated on to the next level. In this proposal, after the QP is assigned to each 3D point based on the geometry position and the box region like Predicting/Lifting case, QP is propagated as following,

* If the node is right side one of RAHT tree, the QP which is assigned to this node will be used to quantize high frequency value after RAHT transform
* Otherwise (the node is left side), the QP which is assigned to this node will be propagated to upper layer node with low frequency value after RAHT transform

# Timeline

2019/11/01 Expected date for release of cross-verified G-PCCv8.0 software and anchors

2019/12/13 Distribution of EE SW and results for verification

2019/12/27 EE verification feedback from cross-checkers to the proponents

2020/01/08 MPEG 129 document upload deadline

# References

1. G-PCC Region-wise Quantization Control in Attribute Coding, ISO/IEC JTC 1/SC29 WG11 Doc. m49626, Gothenburg, SE, July 2019.
2. [G-PCC] EE13.5 Report on Region-wise Quantization Control, ISO/IEC JTC 1/SC29 WG11 Doc. m51063, Geneva, CE, October 2019.
3. G-PCC Test Model v8, ISO/IEC JTC1/SC29/WG11 Doc. w18882, Geneva, CE, October 2019.
4. G-PCC performance evaluation and anchor results, ISO/IEC JTC1/SC29 WG11 Doc. w18885, Geneva, CE, October 2019.