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

**CODING OF MOVING PICTURES AND AUDIO**

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# Abstract

This document provides a description of Core Experiment 13.6 on Attribute LOD generation.

# Mandates

The mandate of the core experiment is to evaluate the proposed methods [1][2][3] to:

1. To evaluate the coding performance of the proposed tools.
2. To evaluate the complexity of the proposed tools.
3. To study how to combine the two nearest neighbor search methods.
4. To study how to combine the two LoD construction methods.
5. To investigate how to extend the combined method into spatial scalable scheme.

# Participants

|  |  |  |  |
| --- | --- | --- | --- |
| ***Participant*** | ***Contact*** | ***Email*** | ***Type*** |
| Xidian University | Wei Zhang | wzhang@xidian.edu.cn | Proponent/Cross-Checker |
| Apple | David Flynn | davidflynn@apple.com | Proponent/Cross-Checker |

# Tools to be evaluated

## Tool 1: nearest neighbour search method from m52302 (Xidian)

In contribution m52302 [3], a neighbour search method for predlift transform was proposed taking into account the geometric structure and spatial distribution of a point cloud. Specifically, candidate predictors of a certain point P are found within its neighbouring regions where high spatial correlation exists. To obtain the neighbouring relationships between points, simple Morton code right shift operations are performed. The initial number of Morton code right shift bits is determined according to a criterion based on point cloud density. The proposed search method is applied on both the inter-LoD and intra-LoD search conditions.

## Tool 2: nearest neighbour search method from m53620 (Apple)

In contribution m53620 [3], a hybrid nearest neighbour search schemes was proposed. It combines:

1. a Look-Up-Table-based (LUT) search of the neighbouring voxels similar to the one described in Section 3.1, with
2. the search technique currently available in TMC13, which searches candidate points in a array of points sorted according to their Morton codes (see Figure 2).

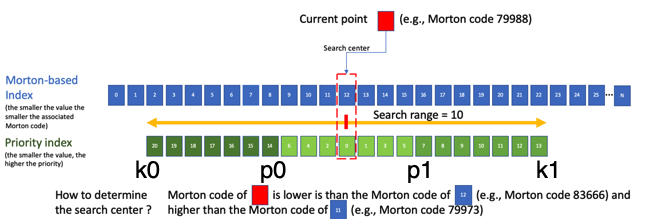


Figure 2: TMC13 searches candidate points in an array of points sorted according to their Morton codes.

For inter LOD k-NN search, the proposed technique applies first the search (1). If the number of found neighbours is lower than k, then the search (2) is applied.

For Intra LOD k-NN search, only search (2) is applied.

## Tool 3: Attribute LoD construction method from m52303 (Xidian)

In contribution m52303 [3], an LoD construction method was proposed taking into account the density of the point cloud as well as the neighbouring relationships. Similar as Tool 1, the proposed method relies on a simple Morton code right shift operation to obtain the neighbouring relationships between points. Points are then divided into a retained set and a refinement layer according to the above-mentioned neighbouring relationship. The initial number of Morton code right shift bits is determined according to a criterion based on point cloud density. As a result, the distance calculation and comparison with a set of thresholds in existing LoD construction scheme are avoided.

## Tool 4: Attribute LoD construction method from m53620 (Apple)

In contribution m53620 [3], the LOD generation scheme in TMC13 is accelerated by examining the points in neighboring voxels according to the LUT-based technique described in Section 3.2. Here, two tests are used to exclude a point:

1. The last retained points has the same shifted Morton code as the current point, or
2. One of the neighboring voxels contains a point with an L2 distance lower than a threshold d0.

# Evaluation

## Test condition

Following test conditions will be evaluated under CTC[4]:

* C1 AI lossless geometry – (lossy attribute)
* C2 AI, lossy geometry – (lossy attribute)
* CW AI, lossless geometry – (lossless attribute)
* CY AI, lossless geometry – (near lossless attribute)

## Test model, datasets

TMC13v10 [5] shall be used for these experiments. The proposed tools shall be implemented on top of TMC13v10.

All tests are to be performed on categories 1 and 3 datasets.

# Timeline

* 2020-05-15: Expected date for release of cross-verified TMC13v10 software and anchors
* 2020-05-29: CE Software and results are released to cross-checkers
* 2020-06-06: Preliminary feedback from cross-checkers to proponents
* 2020-07-01: MPEG document upload deadline

# References

1. “[G-PCC][New proposal] A neighbour search method for predlift transform”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m52302, Brussels, BE, January 2020.
2. “[G-PCC][New proposal] A content-adaptive LOD generation scheme combined with the neighbor search method in m52302”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m52303, Brussels, BE, January 2020.
3. “G-PCC][New proposal] Optimizing Nearest Neighbors Search for Lifting/Prediction Scheme”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m53620, Alpbach, AT, April 2020.
4. “Common Test Conditions for PCC” ISO/IEC JTC1/SC29 WG11 MPEG2020 Doc, w19324, Alpbach, AT, April 2020.
5. “G-PCC Test Model v10”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. w19323, Alpbach, AT, April 2020.