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| **Source:** | **3DG** |
| **Title:** | **Description of Exploration Experiment 13.42 for G-PCC: On decoupling parsing and reconstruction for predicting transform** |

# Abstract

This document provides the description of the exploration experiment 13.42 on decoupling parsing and reconstruction for predicting transform.

Currently, for predicting transform, parsing of predIndex requires attribute reconstruction [1][2]. Removal of such reconstruction dependency is beneficial for a codec, as also pointed out by national body comments. In this EE, methods that remove such dependency are investigated as specified in [4].

# EE13.42 Decoupling parsing and reconstruction dependency for predicting transform

## Mandates

* Study the impact on compression efficiency for the proposed methods in [4] (on TMC13v10 [1]) for lossless and near-lossless coding configurations [3].
* Investigate alternative methods to decouple parsing and reconstruction.

Related changes to the G-PCC Specification Text [2] shall be reported.

## Participants, description of tools, and implementation notes

The following people are participating in this EE. Their specific roles are detailed in the next section. Proposal is based on the following input contribution:

1. m53634, [G-PCC][New] On attribute reconstruction dependency for parsing predIndex in predicting transform.

Proponents and cross checkers are as follows:

| **Name** | **Company** | **E-mail address** | **Type** |
| --- | --- | --- | --- |
| Bappaditya Ray | Qualcomm Inc. | [bray@qti.qualcomm.com](mailto:bray@qti.qualcomm.com) | Proponent (m53634) |
|  |  |  | Crosschecker |

## Information on proposed tool

### Attribute reconstruction dependency for parsing predIndex

Currently, for predicting transform, the attribute of a point in the point cloud is predicted from the attribute values of neighbouring points.For CTC configuration, four different predictors are available: weighted predictor, and its three neighbors, and the predictor index (referred to as predIndex) can be signalled for coding the attribute of a point. (In general, predictors are weighted predictor plus the number of direct predictors signaled in the APS). To reduce the associated signalling, the choice of four different predictors are only made available when the variation of the attribute values is higher than a threshold signalled in APS; in such a scenario predIndex is signalled. When the variation is less than the threshold, weighted predictor (weighted average in Fig. 1) is used by default and thus predIndex is not signalled.

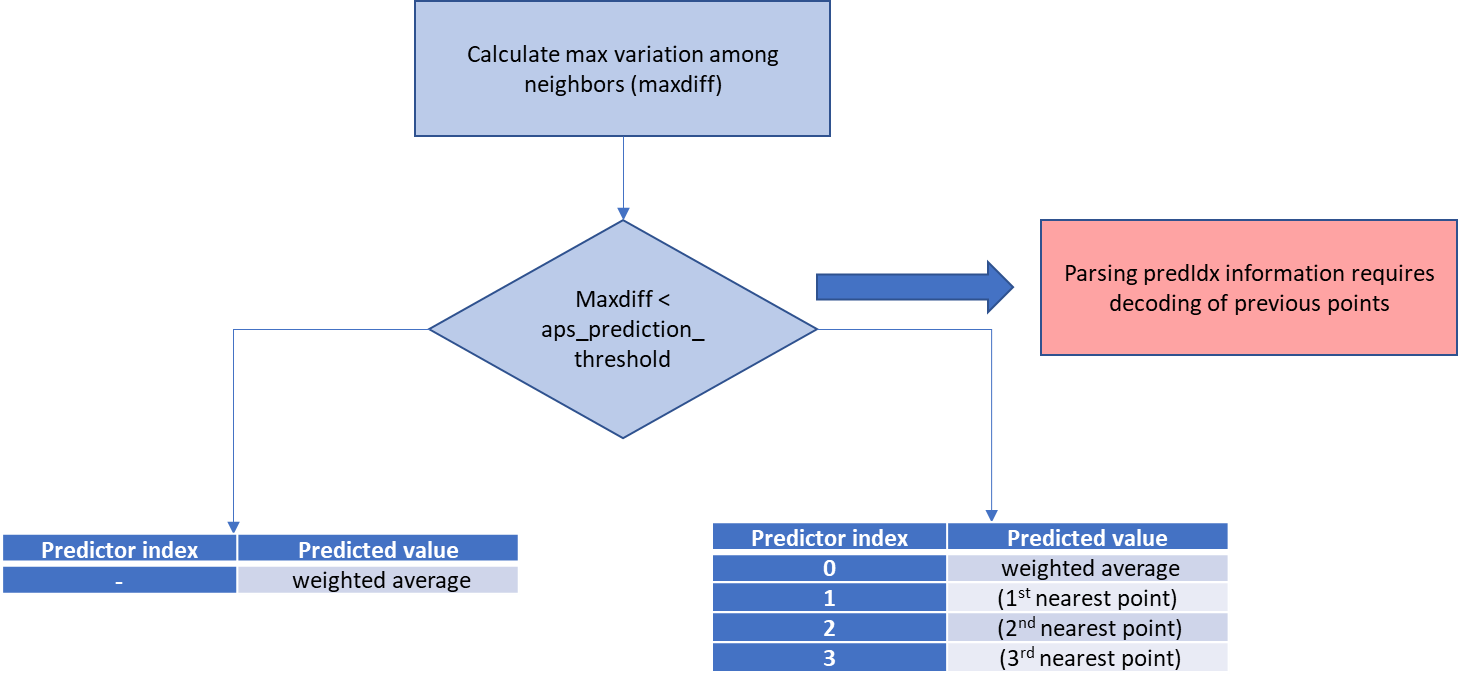


Fig. 1: Prediction process in predicting transform.

Fig. 1 illustrates the prediction strategy. It can be observed that the variation (referred to as maxDiff) is computed using reconstructed attribute values. Thus, the parsing of predIndex requires the reconstruction of the attribute.

Such kind of reconstruction dependency on the parsing is not welcome, as it does not allow to decouple the parsing and the reconstruction process. Decoupling parsing and reconstruction is beneficial for the codec. The reason being CABAC parsing is complex and highly serialized, i.e., symbols need to be parsed in order. If attribute reconstruction is needed for the parsing, that will significantly impact the latency of the overall processing chain. In video coding standards, such dependencies are generally avoided. Consideration of removing such dependency was also mentioned in a national body comment recently.

### Proposed methods in m53634 [4]

The first two methods described in m53634 are respectively: 1) use multiple predictor for all points. 2) use single (weighted) predictor for all points.

A third method that is proposed is to not signal the predIndex explicitly but hide it in the residual parity.

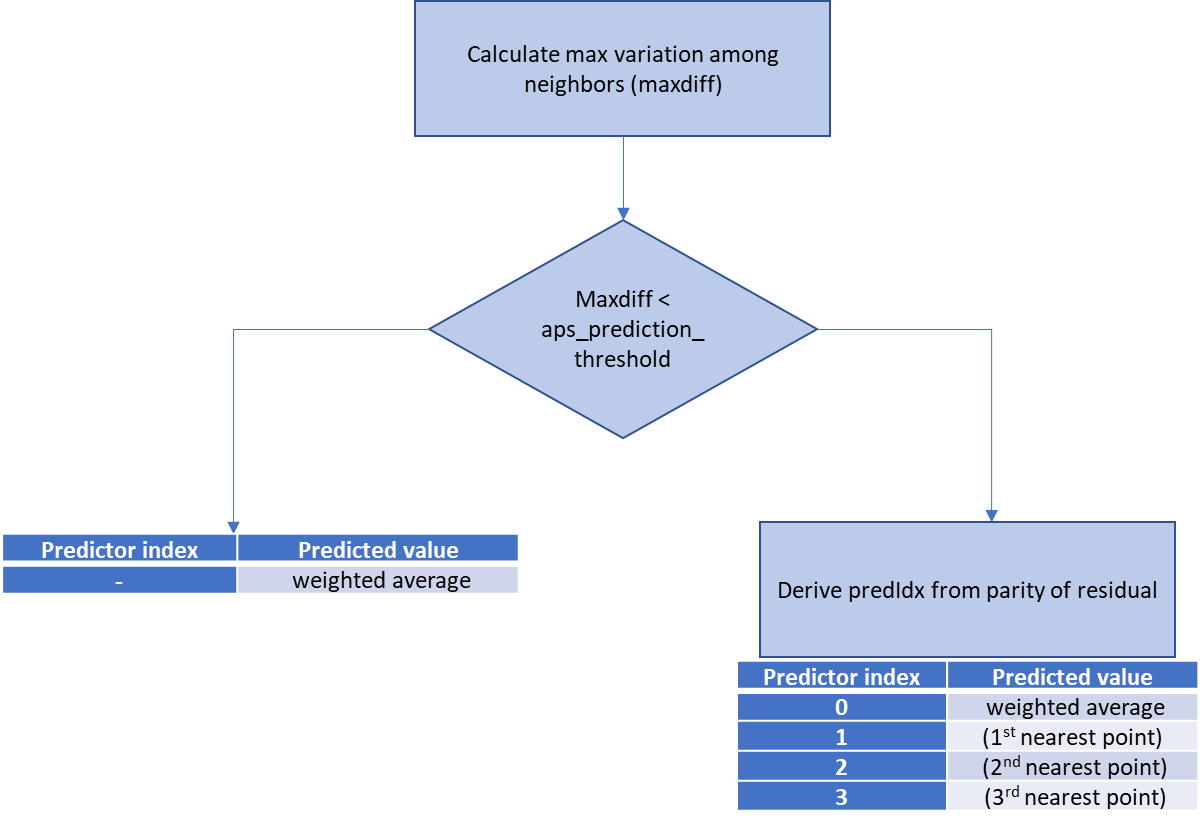


Fig. 2: predIndex hiding process in predicting transform (for colour attribute).

As shown in Fig. 2 above,

1. At the parsing stage no predIndex needs to be parsed.
2. At the reconstruction stage, maxDiff is computed exactly the same way as the anchor. If maxDiff is lower than the threshold, weighted prediction is used. Otherwise, the predIndex is derived from residual parity (details can be found in [4]).

When predIndex hiding needs to be activated, a negative deltaQP may be applied to reduce the stepsize, so that the hausdorff PSNR of the proposed method is the same as the reference (details can be found in [4]). The deltaQP is signaled in APS.

## Information for conducting tests

### Software

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

### Test configurations

Experiments are to be carried out under CTC condition (except for hiding scenario, a delta QP may be applied) with configurations CW\_ai (lossless geometry, lossless attribute) and CY\_ai (lossless geometry, near lossless attribute), as the proposal only impacts the performance of predicting transform.

## EE 13.42 Coordinator

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# Timeline:

* **2020-05-08**: Expected date for TMC13v10 release;
* **2020**-**05-08**: Expected date for release of finalized CE description;
* **2020-05-29 [TMC13v10 + 3 weeks]**:Deliver source code and results for cross check;
* **2020-06-06 [TMC13v10 + 4 weeks]**:Deliver cross check results;
* **2020-07-01**: MPEG document upload deadline.

# References

1. “*G-PCC Test Model v10*”, ISO/IEC JTC1/SC29/WG11 Doc. N19323, Alpbach, Austria, April 2020
2. “*G-PCC Future Enhancements*”, ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. w19328, Alpbach, Austria, April 2020
3. “*Common Test Conditions for PCC*” ISO/IEC JTC1/SC29/WG11 N19324, Alpbach, Austria, April 2020
4. “*[G-PCC][New]* *On attribute reconstruction dependency for parsing predIndex in predicting transform*”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m53634, Alpbach, Austria, April 2020