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| **Source** | **Samsung Electronics** |
| **Status** | **Input contribution** |
| **Title** | **[V-PCC][New Proposal] Bug fix for low complexity color smoothing** |
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# Abstract

Three bug fixes are reported for the simplified low complexity color smoothing tool [1]. This bug fixes make the implementation of this tool in TMC2v8.0 software consistent with the V-PCC specification [2].

# Bug fix for low complexity color smoothing

Bug fix 1: The median function in the TMC2v8.0 is replaced with a correct function. The source code for the new median function is listed below:

double median( std::vector<uint8\_t>& Data, int N ) {

uint8\_t temp;

int i, j;

for ( i = 0; i < N; i++ )

for ( j = i + 1; j < N; j++ ) {

if ( Data[i] > Data[j] ) {

temp = Data[j];

Data[j] = Data[i];

Data[i] = temp;

}

}

if ( N % 2 == 0 )

return ( double( Data[N / 2] ) + double( Data[N / 2 - 1] ) ) / 2.0 ;

else

return double( Data[N / 2] );

}

As a result of this bug fix, the threshold for the luminance difference between neighboring cells has been adjusted to 10.

Bug fix 2: In the low complexity color smoothing method, if the variation of the luminance of the points in the cell which contains a boundary point is larger than a threshold, no color smoothing will be performed on the boundary point. This condition is missing in the TMC2v8.0 software. The bug has been fixed. The code for this bug fix is listed below:

if ( abs( meanY - medianY ) > mmThresh ) {

colorCentroid = curPosColor;

colorCount = 1;

return otherClusterPointCount;

}

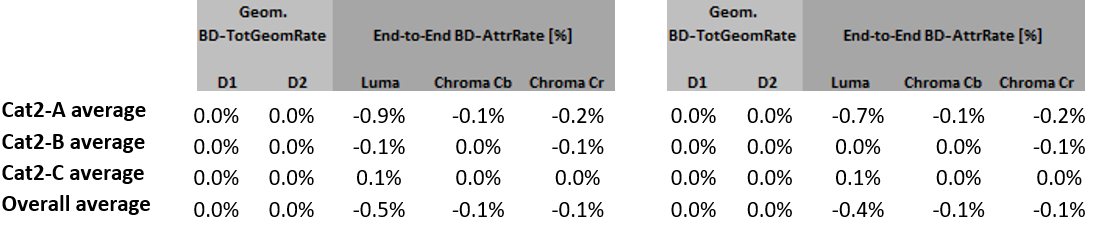
In the above, meanY and median are the average and median value of the luminance of the points in the cell which contains the query boundary point.

Bug fix 3: In the calculation of the luminance of the color centroid in each cell, there is no need to divide the luminance value by the number of points in the cell. By applying this bug fix, the luminance of the color centroid in cell i is calculated as follows:

double Yi = 0.2126 \* colorCentroid[i][0] + 0.7152 \* colorCentroid[i][1] + 0.0722 \* colorCentroid3[i][2]

# Results

Table 1 shows the 32-frame objective results for the bug-fixed low-complexity color smoothing compared with the low-complexity color smoothing tool in TMC2v8.0.



*Table 1 – RD results of bug-fixed low-complexity color smoothing versus low-complexity color smoothing in TMC2v8.0: All Intra (left), Random Access (right)*

# Conclusion

Three bug fixes are reported for the implementation of the low complexity color smoothing tool in TMV2v8.0. We ask to integrate these bug fixes in the V-PCC test model.

# References

1. [V-PCC][New Proposal] Simplified low complexity color smoothing, ISO/IEC JTC1/SC29 WG11 Doc. m49591, Gothenburg, Sweden, July 2019.
2. Text of ISO/IEC DIS 23090-5 Video-based Point Cloud Compression, ISO/IEC JTC1/SC29/WG11 Doc. N18670, October 2019.