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| *Title:* | **Limiting Chroma Transform Depth in Residue Quad Tree (RQT)** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

In Daegu meeting, it is reported (JCTVC-D060) that some loss of chroma coding performance can be observed with Residue Quad Tree (RQT). In this contribution, it is suggested that maximum chroma transform depth be limited relative to luma component, so that chroma component does not have to share the same transform depth as luma. Simulation results show that by doing so an average BD-rate saving of roughly 1% can be obtained for U and V respectively with no loss on luma, using all three HE test configurations.

# Introduction

In Daegu meeting, it is reported in JCTVC-D060 [1] that some loss of chroma components can be observed with RQT coding. One possible reason might be that with the current RQT structure, transform depth is shared between luma and chroma. Chroma components generally are much smoother than luma components, and applying high transform depth on chroma may hurt coding performance.

# Proposed solution

In this contribution, the maximum chroma transform depth is limited using

MaxTUDepthUV = max (0, MaxTUDepthY - T)

where T is a user-defined parameter.

# Experimental results

Simulation is performed based on HM2.0, with **T** = 3, under common test conditions specified in [2].

Since with default coding configuration the maximum transform depth is no larger than 3, With **T**=3, MaxTUDepthUV is equal to 0 with all these test configurations. In this case, For a CU of size 2Nx2N, the transform size of U and V is always NxN (Table 1) .

Table Chroma Transform Size and CU Size (T=3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CU Size | 64x64 | 32x32 | 16x16 | 8x8 |
| Chroma Transform Size | 32x32 | 16x16 | 8x8 | 4x4 |

Simulation results are as follows. Bit rate reduction in HE cases is observed (0.2% for Y, 1.0% for U and 1.2% for V). For LoCo case, there is only very minor change in the overall performance. Probably this is because in HM2.0 HE coding, maximum RQT depth is set to be 3, and chroma blocks may be over-split since it goes with luma. In LoCo coding, the max depth is smaller (2 for Inter and 1 for intra), so the advantage from limiting chroma transform depth is not that big.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Y | U | V | Encoding Time | Decoding Time |
| Intra | -0.1 | -1.1 | -1.4 | 100% | 98% |
| RA | -0.2 | -0.7 | -1.1 | 94% | 100% |
| LD | -0.2 | -1.2 | -1.2 | 96% | 98% |
| **HE Avg.** | **-0.2** | **-1.0** | **-1.2** | **97%** | **98%** |
|  |  |  |  |  |  |
| Intra LoCo | 0.0 | -0.2 | -0.2 | 99% | 100% |
| RA LoCo | -0.1 | 0.3 | 0.0 | 97% | 99% |
| LD LoCo | -0.3 | 0.3 | 0.3 | 94% | 100% |
| **LoCo Avg.** | **-0.1** | **0.1** | **0.0** | **97%** | **100%** |



# Conclusion

In this contribution, we further limit chroma transform depth in RQT relative to luma. As a result, chroma component does not have to share the same transform depth as luma. Coding efficiency improvement is observed in most of the test cases. We recommend some flexibility be allowed in assigning different maximum TU depth for luma and chroma.

# References

1. M. Zhou and A. Tabatabai, “Evaluation Results on Residual Quad Tree (RQT)”, JCTVC-D060, JCT-VC Meeting, Daegu, KR, Jan. 2011.
2. F.Bossen, “Common test conditions and software reference configurations”, JCTVC-D600, JCT-VC Meeting, Daegu, KR, Jan. 2011.

# Patent rights declaration(s)

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