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| *Title:* | **3D-CE6.h related: Fast DMM Selection for Depth Intra Coding** | | | |
| *Status:* | Input Document | | | |
| *Purpose:* | Proposal | | | |
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# Abstract

This contribution proposes further simplifications of mode decision process on HEVC depth intra coding. In current encoding process, all the Depth Modelling Modes (DMM) are added to the full-RD search list for full-RD cost calculation. In this contribution, it is proposed that for most the cases, the DMM full-RD search could skiped since the most CU is very flat or smooth and DMMs are designed for CU with edge or sharp transition. Using Most Probable Mode (MPM) as the indicator, we proposed a fast DMM selection algorithm to speedup the encoding process. It is reported that roughly 15% encoding time is saved and 0.2% bitrate increasing in coded and synthsized view for All-Intra test case is observed using this proposed method.

# Introduction

In current 3D-HEVC design[1], DMM is utilized together with the intra coding scheme of HEVC for intra coding of depth map. During the mode selection process, a full RD search list is created and several MPMs (8 for 4x4 and 8x8 CU size, 3 for 16x16, 32x32, 64x64 CU size) are selected from 36 Intra prediction modes for full-RD cost calculation. After selection of several MPMs, all the DMMs are also added to the full-RD search list. It is observed that after full-RD search, DMMs have less than 10% probability to be selected as best mode. This is because most of the CUs in depth map are flat or smooth, and DMMs are designed for CU with edge or sharp transition which is less efficient for smooth CU compression.

# Proposed Solution

Based on this observation, we propose a pre-selection process to early terminate the DMM full-RD cost calculation.

## Pre-selection based on the first mode in full-RD cost calculation list (uiRdModeList[0])

It is observed that when the first mode in full-RD cost calculation list is planar mode (uiRdModeList[0] == 0), the CU is very like to be flat or smooth. Therefore, under this condition, all the DMMs full-RD cost calculation are skipped.

## Refinement for DMM mode1 without delta CPVs (DMM\_WEDGE\_FULL\_IDX) and DMM mode3 with delta CPVs (DMM\_WEDGE\_PREDTEX\_D\_IDX)

Under the Pre-selection condition in Section 2.1., most unnecessary DMM full-RD cost calculation is skipped. However, it still misses some cases when DMM is selected as the best mode under that condition. Close survey shows that for those missed DMMs, DMM mode1 without delta CPVs (DMM\_WEDGE\_FULL\_IDX) and DMM mode3 with delta CPVs (DMM\_WEDGE\_PREDTEX \_D\_IDX) are the two most probable DMMs. For these two DMMs, we observe that when they are missed, the second mode in full-RD cost calculation list is very likely to be DC (uiRdModeList[1] == 1).

Based on previous analysis, we summarize the proposed fast DMM mode decision procedure in Figure 1:



Figure 1. Fast DMM mode decision for Intra Depth Coding

# Experimental Results

The proposed method is implemented on HTM5.1 software.

Table1 shows the coding performance of 3-view case under common test condition [2] for random acess. Table2 shows the coding performance of 3-view case for all intra case. It is observed that 14.6% encoding time saving and 0.2% bitrate increasing in coded and synthsized view.

Table 1: BD rate results for 3-view case under CTC, Random Access

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video only | synthesized only | coded & synthesized | enc time | dec time | ren time |
| Balloons | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 99.6% | 98.8% | 91.8% |
| Kendo | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 99.1% | 98.7% | 97.1% |
| Newspapercc | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 99.1% | 100.2% | 96.7% |
| GhostTownFly | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 97.5% | 94.3% | 97.6% |
| PoznanHall2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 99.1% | 95.3% | 94.5% |
| PoznanStreet | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 98.7% | 92.7% | 96.0% |
| UndoDancer | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 99.7% | 101.2% | 98.4% |
| 1024x768 | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% | 99.3% | 99.2% | 95.2% |
| 1920x1088 | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% | 98.8% | 95.8% | 96.6% |
| **average** | **0.0%** | **0.0%** | **0.0%** | **0.0%** | **0.1%** | **0.0%** | **99.0%** | **97.3%** | **96.0%** |

Table 2: BD rate results for 3-view case under CTC, ALL Intra

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video only | synthesized only | coded & synthesized | enc time | dec time | ren time |
| Balloons | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.1% | 84.1% | 101.2% | 98.1% |
| Kendo | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 0.2% | 83.5% | 103.3% | 100.7% |
| Newspapercc | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% | 0.2% | 88.4% | 101.3% | 100.3% |
| GhostTownFly | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 86.0% | 100.4% | 99.2% |
| PoznanHall2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 0.2% | 84.6% | 97.7% | 99.1% |
| PoznanStreet | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 84.4% | 99.9% | 97.6% |
| UndoDancer | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.1% | 86.6% | 98.0% | 97.4% |
| 1024x768 | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 0.2% | 85.3% | 101.9% | 99.7% |
| 1920x1088 | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.1% | 85.4% | 99.0% | 98.3% |
| **average** | **0.0%** | **0.0%** | **0.0%** | **0.0%** | **0.2%** | **0.2%** | **85.4%** | **100.2%** | **98.9%** |

# Conclusion

Fast mode selection algorithm of intra depth coding for 3D-HEVC is proposed. The proposed method avoids uncessary DMM full-RD cost calculation based on the selection MPMs. It is reported that there is 14.6% encoding time saving and 0.2% bitrate increasing in coded and synthsized view using the proposed method on HTM-5.1. It is sugested to inlcude the fast DMM selection method in HTM5.1.

# References

[1] G. Tech, K. Wegner, Y. Chen, S. Yea “3D-HEVC Test Model 2” , JCT3V-B1005, 2nd Meeting: Shanghai, CN , 13–19 Oct. 2012.

[2] D. Rusanovskyy, K. Mueller, A. Vetro, “Common Test Conditions of 3DV Core Experiments” JCT3V-B1100, 2nd Meeting: Shanghai, CN , 13–19 Oct. 2012.

# Patent rights declaration(s)

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