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| **Joint Collaborative Team on 3D Video Coding Extension Development**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  2nd Meeting: Shanghai, CN, 13–19 Oct. 2012 | Document: JCT2-B0091 |

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| *Title:* | **Motion data buffer reduction for 3D-HEVC** | | |
| *Status:* | Input Document | | |
| *Purpose:* | Proposal | | |
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# Abstract

In the HEVC-based 3D video coding, HTM 4.0.1, motion data of each coded picture is stored at lower resolution after all pictures within the same access unit (AU) are coded. However, it requires larger buffers and causes bandwidth issue to store and access the motion data at full resolution when coding the pictures within an AU. In this contribution, we propose to store the motion data of each picture at quarter resolution during the coding of the pictures within the access unit (AU) and compress them at 1/16 resolution after all pictures within the same AU are coded. With this proposed scheme, the motion data buffer and the memory access bandwidth for writing and reading motion data can be further reduced. The experimental results reportedly show that 0.1% BD-rate increase for overall coded and synthesized views is introduced while the motion data buffer can be significantly reduced.

# Introduction

In the HEVC-based 3D video coding, HTM-4.0.1 [1], motion information is used for motion vector prediction. Therefore, the motion data of each coded picture needs to be stored in a motion data buffer. To reduce the size of the motion data buffer, the motion compression process is applied to store the decoded motion data of each picture at a lower resolution. It uses decimation to store motion vectors on a larger granularity instead of 4x4.

Fig. 1 shows the decimation of motion data in HTM-4.0.1, motion data of each picture is stored at full resolution during the coding of the pictures within the access unit (AU). After all the pictures within the same AU are coded, the motion data compression is conducted for each 16x16 block, and all the 4x4 blocks within each 16x16 unit share the motion vectors, reference picture indices and prediction mode of the representative block. Currently, the top left 4x4 block is used as the representative block for the whole 16x16 block



**Figure 1. The motion data buffer reduction in HTM-4.0.**

# Proposed Method

In this contribution, as shown in Figure 2, we propose to store the motion data of each picture at quarter resolution during the coding of the pictures within the AU. That is, for each 8x8 unit, the motion parameter of the top-left 4x4 block is used as the representative motion parameter. Therefore, the motion data is stored in a motion data buffer of quarter size after each picture is coded. After all pictures within the same AU are coded, the same procedure is then performed to the motion parameters that are already compressed. After the second motion data buffer reduction, motion data is stored in a motion data buffer of 1/16 size, which poses the same decimation results as current HTM. As can be seen in Figure 2, since the storage is reduced, the bandwidth for writing and reading motion data can also be reduced by the proposed scheme.



**Figure 2. The proposed scheme for motion data buffer reduction.**

# Experimental Results

The proposed MV decimation method is conducted based on HTM-4.0.1 [1] under the recommended test conditions [2]. The results are shown in Table 1. The experiments results show that the performance loss taken by the proposed scheme for motion data buffer reduction is about 0.1% BD-rate increase for coded and synthesized results, while the internal motion data buffer during the coding of the pictures within the AU can be reduced to 1/4.

**Table 1. The BD-rate result of removing TMVP in depth map coding**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Video 1 | Video 2 | Video only | Synthesized only | Coded & synthesized | Enc time | Dec time | Ren time |
| Balloons | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 100.9% | 100.8% | 99.1% |
| Kendo | 0.0% | 0.2% | 0.0% | 0.2% | 0.2% | 100.5% | 101.9% | 106.3% |
| Newspapercc | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 99.9% | 102.1% | 101.3% |
| GhostTownFly | 0.1% | 0.2% | 0.0% | 0.1% | 0.1% | 101.5% | 102.0% | 100.9% |
| PoznanHall2 | 0.1% | 0.8% | 0.2% | 0.1% | 0.1% | 101.1% | 102.0% | 100.6% |
| PoznanStreet | -0.2% | 0.3% | 0.0% | 0.1% | 0.1% | 100.4% | 100.5% | 100.0% |
| UndoDancer | 0.1% | 0.3% | 0.1% | 0.1% | 0.1% | 100.5% | 100.1% | 100.0% |
| 1024x768 | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% | 100.4% | 101.6% | 102.2% |
| 1920x1088 | 0.0% | 0.4% | 0.1% | 0.1% | 0.1% | 100.9% | 101.2% | 100.4% |
| **average** | 0.0% | 0.3% | 0.1% | 0.1% | 0.1% | 100.7% | 101.4% | 101.2% |

# Conclusion

This contribution proposed a motion data decimation method, which stores the motion data in a larger granularity instead of 4x4 block during the coding of the pictures within the access unit (AU). In this proposed scheme, for each 8x8 unit, the motion parameter of the top-left 4x4 block is used as the representative motion parameter. After all pictures within the AU are all coded, the motion data is further reduced to produce 16:1 motion data compression as used in current HTM. With the proposed scheme, the motion data buffer and the memory access bandwidth are both reduced with only 0.1% BD-rate increase.

# Patent rights declaration (s)

**MediaTek Inc. may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

# References

[1] HTM-4.0.1, <https://hevc.hhi.fraunhofer.de/svn/svn_3DVCSoftware/tags/HTM-4.0.1/>

[2] Dmytro Rusanovskyy, Karsten Müller, Anthony Vetro, “Common Test Conditions of 3DV Core Experiments”, Joint Collaborative Team on 3D Video Coding Extension Development of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, JCT3V-A1100, July 2012, Stockholm.