|  |  |
| --- | --- |
| **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: JCT3V-B0085 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Removal of picture buffers for motion parameter inheritance** | | |
| *Status:* | Input Document | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Yi-Wen Chen, Jian-Liang Lin, Yu-Wen Huang, and Shawmin Lei  No. 1, Dusing Rd. 1, Hsinchu Science Park, Hsinchu, Taiwan 30078 | Tel: Email: | Shawmin Lei +886-3-5670766 ext. 25555  {yiwen.chen, jl.lin, yuwen.huang shawmin.lei}@mediatek.com |
| *Source:* | MediaTek Inc. | | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Abstract

In the HEVC-based 3D video coding, HTM 4.0.1, the motion information of corresponding texture can be referred in the depth coding through the motion parameter inheritance (MPI). Since the MPI reuses the CU/PU structures and motion data from the texture, additional buffers for the prediction directions and CU/PU structures are required for the MPI. As an alternative to the MPI, in this contribution, a texture merging candidate is proposed as an additional candidate for merge mode and skip mode. The texture merging candidate only reuses the motion vector (MV) and reference index of the corresponding texture block. The experimental results reportedly show that the proposed scheme achieves 0.9% BD-rate savings for overall coded and synthesized views compared to HTM-4.0.1, while the picture buffers for the prediction directions and CU/PU structures can be removed and the encoding/decoding run time are also reduced.

# Introduction

In the HEVC-based 3D video coding, HTM-4.0.1, in order to support the motion parameter inheritance (MPI) for depth coding, extra buffers are required to store the CU/PU structure information and prediction directions (inter\_dir) of the corresponding texture picture. In this contribution, as an alternative and a simplification to the MPI, we propose a texture merging candidate for depth coding to directly reuse the motion vectors (MVs) and reference index of the corresponding texture block which have already been stored for the derivation of the temporal merging candidate. In this proposed texture merging candidate, the CU/PU structure information of the texture picture is not used and thus needs no additional buffer.

# Proposed method

In this contribution, we propose to add one additional candidate, texture merging candidate, into the merge candidate set for the depth merge/skip mode coding. In texture coding, the motion vectors (MVs) and reference index of the corresponding block in the inter-view are reused as an inter-view merging candidate. Similar to the concept of inter-view merging candidate, the proposed texture merging candidate directly reuse the motion vectors (MVs) and reference index of the corresponding texture block as a merging candidate in depth coding. As shown in Figure 1, the corresponding texture block is selected as the 4x4 block located to the right bottom of the center of the current PU in the corresponding texture picture. With this proposed scheme, the merge operations for texture and depth are also unified, as shown in Table 1, which could reduce the overhead in terms of software or hardware design. Note that, since the texture merging candidate directly reuses the motion parameters from the corresponding texture block, no MV scaling is required.



**Figure 1. The derivation of corresponding texture block**

**Table 1. Comparisions of merge candidate sets**

|  |  |  |  |
| --- | --- | --- | --- |
| Merge candidate set in HTM-4.0.1 | | Merge candidate set in the proposed scheme | |
| Texture | Depth | Texture | Depth |
| 1. Inter-view candidate  2. Spatial candidate  3. Temporal candidate  4. Additional candidate | 1. MPI  2. Spatial candidate  3. Temporal candidate  4. Additional candidate | 1. Inter-view candidate  2. Spatial candidate  3. Temporal candidate  4. Additional candidate | 1. Texture candidate  2. Spatial candidate  3. Temporal candidate  4. Additional candidate |

# Experimental results

To utilize the motion information of texture for depth coding, we propose to use the texture merging candidate instead of MPI for buffer reduction. Table 2 shows the coding loss by disabling MPI in HTM-4.0.1 [1]. The experimental results show that the MPI can provide about 1.4% overall BD-rate savings. In the proposed scheme, the texture merging candidate is applied to replace the MPI. The proposed scheme is integrated into HTM-4.0.1, and all tests are conducted under the common test conditions [2]. The experimental results are shown in Table 3. It shows that the proposed scheme achieves an average 0.9% overall BD-rate savings, while the additional buffers for CU/PU structure are removed and the encoding/decoding run time are also reduced.

**Table 2. The BD-rate results of disabling MPI**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Video 1 | Video 2 | Video only | Synthesized only | Coded & synthesized | Enc time | Dec time | Ren time |
| Balloons | 0.0% | 0.0% | 0.0% | 1.4% | 1.1% | 96.2% | 96.6% | 100.3% |
| Kendo | 0.0% | 0.0% | 0.0% | 3.3% | 2.7% | 96.3% | 95.9% | 98.5% |
| Newspapercc | 0.0% | 0.0% | 0.0% | 2.1% | 1.7% | 95.9% | 98.7% | 100.0% |
| GhostTownFly | 0.0% | 0.0% | 0.0% | 1.2% | 0.8% | 95.7% | 96.2% | 100.1% |
| PoznanHall2 | 0.0% | 0.0% | 0.0% | 1.6% | 1.0% | 96.9% | 99.2% | 103.2% |
| PoznanStreet | 0.0% | 0.0% | 0.0% | 1.0% | 0.8% | 96.9% | 98.4% | 100.2% |
| UndoDancer | 0.0% | 0.0% | 0.0% | 1.8% | 1.5% | 97.0% | 99.3% | 100.0% |
| 1024x768 | 0.0% | 0.0% | 0.0% | 2.3% | 1.8% | 96.1% | 97.1% | 99.6% |
| 1920x1088 | 0.0% | 0.0% | 0.0% | 1.4% | 1.0% | 96.7% | 98.3% | 100.9% |
| **average** | 0.0% | 0.0% | 0.0% | 1.8% | 1.4% | 96.4% | 97.8% | 100.3% |

**Table 3. The BD-rate results of disabling MPI and enabling texture merging candidate**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Video 1 | Video 2 | Video only | Synthesized only | Coded & synthesized | Enc time | Dec time | Ren time |
| Balloons | 0.0% | 0.0% | 0.0% | -0.9% | -0.9% | 96.4% | 99.1% | 101.0% |
| Kendo | 0.0% | 0.0% | 0.0% | -0.7% | -0.7% | 96.8% | 98.0% | 99.4% |
| Newspapercc | 0.0% | 0.0% | 0.0% | -0.3% | -0.3% | 96.6% | 98.3% | 99.7% |
| GhostTownFly | 0.0% | 0.0% | 0.0% | -0.7% | -0.7% | 96.4% | 98.5% | 100.6% |
| PoznanHall2 | 0.0% | 0.0% | 0.0% | -2.2% | -2.2% | 97.1% | 96.8% | 97.7% |
| PoznanStreet | 0.0% | 0.0% | 0.0% | -0.7% | -0.7% | 97.8% | 99.9% | 100.9% |
| UndoDancer | 0.0% | 0.0% | 0.0% | -0.5% | -0.4% | 97.1% | 97.6% | 101.2% |
| 1024x768 | 0.0% | 0.0% | 0.0% | -0.6% | -0.7% | 96.6% | 98.5% | 100.1% |
| 1920x1088 | 0.0% | 0.0% | 0.0% | -1.0% | -1.0% | 97.1% | 98.2% | 100.1% |
| **average** | 0.0% | 0.0% | 0.0% | -0.8% | -0.9% | 96.9% | 98.3% | 100.1% |

# Conclusion

In this proposal, a texture merging candidate is added to the merge candidate set for depth coding, as an alternative and a simplification to the MPI, to remove the picture buffers for the CU/PU partition information and prediction directions in the MPI. The experimental results reportedly show that the proposed scheme introduces an average 0.9% BD-rate savings for coded and synthesized views with reduced encoding/decoding run time. With this proposed approach, the buffer for CU/PU partition information and prediction directions can be removed, and the merge operations in texture and depth can also be unified.

# 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. D. Rusanovskyy, K. Müller, A. Vetro, “Common test conditions of 3DV Core Experiments,” Document of Joint Collaborative Team on 3D Video Coding Extension Development, JCT3V-A1100, July, 2012.