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| *Title:* | **3D-CE2.a: MB-level depth-to-DV conversion in ATM** | | |
| *Status:* | Input Document | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Jian-Liang Lin, Yi-Wen Chen, Yu-Wen Huang, and Shawmin Lei (MediaTek)  Jin Young Lee, Ho-Cheon Wey, Chanyul Kim (Samsung)  Gun Bang, Won-Sik Cheong, Namho Hur (ETRI)  Kyung Yong Kim, Young Su Heo, Gwang Hoon Park (KHU) | Tel: Email: | Shawmin Lei +886-3-5670766 ext. 25555 {jl.lin, yiwen.chen, yuwen.huang [shawmin.lei}@mediatek.com](mailto:shawmin.lei%7d@mediatek.com)  [jinyoung79.lee@samsung.com](mailto:jinyoung79.lee@samsung.com)  [gbang@etri.re.kr](mailto:gbang@etri.re.kr)  [kimky@khu.ac.kr](mailto:kimky@khu.ac.kr) |
| *Source:* | MediaTek Inc., Samsung Electronics Co. Ltd., ETRI and KyungHee University | | |

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# Abstract

This contribution presents the results of CE2.a experiments related to the simplification of the disparity derivation proposed in JCT3V-C0134. In the AVC-based 3D video coding, ATM-7.0, the depth-to-DV conversion is performed once for each macroblock (MB) to derive the inter-view MVP in Skip and Direct mode. However, in Inter mode, the depth-to-DV conversion needs to be performed multiple times in motion vector prediction to derive DVs for various partition blocks in one MB. In the proposal, the MB-level depth-to-DV proposed in JCT3V-C0134 is tested again to see its impact on ATM-7.0. The experimental results reportedly show that this proposed simplification brings no coding loss compared to ATM-7.0 while the complexity for DV derivation could be further reduced.

# Introduction

In current 3D-AVC[1], a disparity vector (DV) conversion scheme of maximal out of four corners (shortened as four-corner schemes in the following paragraphs) is utilized in Skip and Direct mode, motion vector prediction and view synthesis prediction (VSP). The disparity for currently coded texture block is derived from the depth value of four corner samples in a depth block associated with currently coded texture block. The depth values of four corner samples are compared against each other and maximal depth value among them is converted to a DV.

In current design, a MB-level four-corner scheme is utilized to derive a DV to locate the reference block in the base view for Skip and Direct mode. As for the motion vector prediction, when a temporal motion vector or inter-view motion vector is not available for each neighboring block, a sub-MB level four-corner scheme is employed to derive a DV.

To derive the inter-view MVP for Skip and Direct mode, the DV conversion is only needed to be performed once for each macroblock (MB). However, in Inter mode, the depth-to-DV conversion needs to be performed multiple times for the motion vector prediction because each partition block needs to derive its own DV. An example is illustrated in Figure 1, when current MB is coded as a 16x16 partition MB, only one DV conversion is performed. However, sixteen DV conversions are required when current MB is partitioned into 4x4 partitions.

 

**Figure 1. DV conversion in case a 16x16 MB under (a) 16x16 partition (b)4x4 partitions.**

# Proposed Method

In CE2 [2], to target at a simplified and robust solution for disparity vector derivation for 3D-AVC, a simplified DV derivation method proposed in JCT3V-B0073[3] and JCT3V-C0134[4] is tested. In JCT3V-C0134, it was proposed, to make all partition blocks of Inter mode within the same MB share the same DV which is derived from a maximum depth value of four corner samples in the associated depth block of current MB. In the proposed MB-level depth-to-DV conversion scheme, the depth-to-DV conversion only needs to be performed once for Skip, Direct and Inter mode for each MB, the accessed depth samples and computational complexity can thus be reduced and the depth-to-DV operations between Skip, Direct and Inter mode are also unified.

# Experimental Results

The proposed simplification is integrated into ATM-7.0 [1] and the simulations are run under the common test conditions[5]. The results of using MB-level depth-to-DV conversion are illustrated in Table 1. The experimental results show that this proposed simplification brings no coding loss while the computational complexity and memory access bandwidth are reduced. One additional experiment is also conducted to further reduce the number of the access depth samples for VSP. Based on the proposed MB-level depth-to-DV conversion, the basic unit for VSP is also enlarged from 4x4 to 8x8. The results of the additional experiment are illustrated in Table 2. As shown in the table, with this further simplification, only 0.17% overall BD-rate increase is introduced. The comparison of the number of the depth sample access between the anchor and the experiments are also illustrated in Table 1. Compared to the anchor, the proposed simplification can significantly reduce the number of memory access at worst cases (4x4) with almost no coding loss.

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|  | Number of memory access | | | | | |
| BVSP | | Motion Partition | | | |
| MV Prediction | | | Skip/Direct |
| 4x4 | 8x8 | 4x4 | 8x8 | 16x16 |
| Anchor  (ATM-7.0) | 64 | - | 64 | 16 | 4 | 4 |
| Experiment  (MB-level DV conversion) | 64 | - | 4 | 4 | 4 | 4 |
| Additional Experiment  (MB-level DV conversion & 8x8 VSP) | - | 16 | 4 | 4 | 4 | 4 |

Table 1 Results of using the proposed MB-level depth-to-DV conversion



Table 2 Results of using the proposed MB-level depth-to-DV conversion with 8x8 VSP



# Conclusion

This contribution proposes a MB-level depth-to-DV conversion scheme to simplify current design. The results reportedly showed that the proposed simplification brings no coding loss while the complexity and memory access bandwidth are reduced.

# Patent rights declaration (s)

**MediaTek Inc., Samsung Electronics Co. Ltd., ETRI and KyungHee University 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] ATM-7.0, <http://mpeg3dv.research.nokia.com/svn/mpeg3dv/tags/3DV-ATMv7.0/>

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