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| *Title:* | **3D-CE5.h related: Unification of inter-view candidate derivation for 3D-HEVC** | | |
| *Status:* | Input Document | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Li Zhang Ying Chen Liu He Marta Karczewicz  5775 Morehouse Drive San Diego, CA 92121 USA | Tel: Email: | 1-858-651-6660 [lizhang@qti.qualcomm.com](mailto:lizhang@qti.qualcomm.com)  1-858-845-6589 [cheny@qti.qualcomm.com](mailto:cheny@qti.qualcomm.com) |
| *Source:* | Qualcomm Incorporated | | |

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# Abstract

Inter-view motion prediction is enabled for both merge and AMVP modes in current 3D-HEVC. With inter-view motion prediction enabled, a Temporal Inter-View motion vector predictor Candidate (TIvC) may be derived based on the motion information of the reference block in a reference view. Given a target reference picture list X (RefPicListX, with X being 0 or 1), the availability of TIvC, i.e., only motion information in RefPicListX of the reference block is checked for merge mode, and motion information of both RefPicList0 and RefPicList1 are checked in order for AMVP mode. In this proposal, the checking order of both merge and AMVP mode is unified, i.e., regardless merge or AMVP mode, motion information corresponding to RefPicListX is checked first and the motion information corresponding to RefPicListY (with Y equal to 1-X) is checked afterwards. The proposed method unifies the inter-view motion prediction processes for AMVP and merge modes while doesn’t introduce any coding loss (0.02% gain).

1. **Introduction**

In current 3D-HEVC, for the merge mode, given a target reference picture list X (X could be 0 or 1), the Temporal Inter-View motion vector predictor Candidate (TIvC) is derived by the following steps:

* A reference block of current prediction unit in a reference view of the same access unit is located by the disparity vector.
* If the reference block is not intra-coded and not inter-view predicted and its reference picture RefPicListX[ ref\_idx\_lx ] has a Picture Order Count (POC) value equal to that of one entry RefPicListX[ RefIdxLx ] in the same reference picture list of current prediction unit, its motion information (prediction direction, reference pictures, and motion vectors), after converting the reference index based on POC (i.e., RefIdxLx) is derived to be the inter-view predicted motion vector.

However, for the AMVP mode, when the target reference picture corresponds to a temporal reference picture, TIvC is derived by the following steps:

* A reference block of current prediction unit in a reference view of the same access unit is located by the disparity vector.
* If the reference picture in RefPicList0 of the reference block is available has the same POC value as that of the target reference picture of the current prediction unit, the corresponding motion vector in RefPicList0 is returned as TIvC.
* Otherwise, the POC value of the reference picture in RefPicList1 is checked. If it is available and equal to that of the target reference picture of the current prediction unit, the corresponding motion vector in RefPicList1 is returned as TIvC.

The current design has the following drawbacks:

* Different modules are required to implement the inter-view candidate derivation process.
* When reference pictures with the same POC values are in different reference picture lists of the reference block and current block, TIvC may be set unavailable which degrades the coding efficiency. For example, one reference block is uni-predicted from RefPicList1 with the POC value of the reference picture with POC equal to M, while the picture with POC equal to M is not included in RefPicList1 but in RefPicList0 of current block. During the merge mode, TIvC is set unavailable since only the same reference picture list of the reference block is checked.

1. **Proposed Method**

To unify the TIvC derivation process for AMVP and merge modes, the following steps are proposed to be applied to both AMVP and merge modes:

Given a target reference picture list X, a flag bMRG to denote it is AMVP or merge mode, a target reference picture index RefIdxLx for AMVP mode, the following apply:

* A reference block of current prediction unit in a reference view of the same access unit is located by the disparity vector.
* If the reference block is not intra-coded and not inter-view predicted, the following apply:
  + If its reference picture RefPicListX[ ref\_idx\_lx ] has a POC value equal to that of one entry RefPicListX[ RefIdxLx ] in the same reference picture list of current prediction unit, its motion information (prediction direction, reference pictures, and motion vectors), after converting the reference index based on POC (i.e., RefIdxLx) is derived to be the inter-view predicted motion vector.
  + Otherwise, the reference picture RefPicListY[ ref\_idx\_ly ] of the reference block has a POC value equal to that of one entry RefPicListX[ RefIdxLx ] where Y is equal to (1-X), the corresponding motion vector in RefPicListY is returned as TIvC.

Note for the AMVP mode, RefIdxLx is equal to the target reference picture index while for merge mode, it could be any entry in a reference picture list.

1. **Compression Performance**

This section provides simulation results of the proposed ARP in comparison with the 3D-HTM anchor. The platform 3D-HTM 5.0.1 [1] is utilized and the proposed method is implemented on it. All the simulation tests are performed based on the common test conditions [2].

Table 1 provides the results of the proposed method compared with 3D-HTM anchor with the first test set. Minor coding gain could be observed, i.e., 0.1% for Video 2, 0.02% for synthesized views.

Table : Coding gain with respect to anchor for 3-view case

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 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% | 0.0% | 94% | 97% | 95% |
| Kendo | -0.3% | -0.2% | -0.1% | -0.1% | -0.1% | 93% | 90% | 101% |
| Newspapercc | -0.1% | -0.1% | 0.0% | -0.1% | -0.1% | 94% | 94% | 98% |
| GhostTownFly | 0.1% | -0.3% | 0.0% | -0.1% | 0.0% | 102% | 105% | 111% |
| PoznanHall2 | 0.5% | 0.1% | 0.1% | 0.1% | 0.1% | 95% | 97% | 99% |
| PoznanStreet | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 98% | 104% | 105% |
| UndoDancer | -0.2% | -0.2% | -0.1% | -0.1% | -0.1% | 95% | 106% | 102% |
| 1024x768 | -0.1% | -0.1% | -0.1% | 0.0% | 0.0% | 94% | 94% | 98% |
| 1920x1088 | 0.1% | -0.1% | 0.0% | 0.0% | 0.0% | 97% | 103% | 104% |
| **average** | **0.00%** | **-0.10%** | **-0.02%** | **-0.02%** | **-0.02%** | **96%** | **99%** | **101%** |

1. **References**
2. 3D-HTM version 5.0.1: <https://hevc.hhi.fraunhofer.de/svn/svn_3DVCSoftware/tags/HTM-5.0.1/>.
3. D. Rusanovskyy, K. Müller, A. Vetro, "Common Test Conditions of 3DV Core Experiments," ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, JCT3V-B1100, 2nd Meeting: Shanghai, CN, 13–19 Oct. 2012.
4. **Patent rights declaration(s)**

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