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| *Title:* | **3D-CE2.h related: Enhanced disparity vector derivation** | | |
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| *Purpose:* | Proposal | | |
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# Abstract

This proposal presents modifications of the disparity vector (DV) derivation. In the current 3D-HEVC design, a DV is searched out from pre-defined spatial and temporal neighboring blocks, and the derivation process is terminated once a disparity motion vector is found. However, the early termination may result in a relatively inaccurate DV. Thus, in this contribution, it is proposed to determine the DV by employing multiple disparity vector candidates generated from the neighboring blocks. The disparity vector candidates are still from the spatial and temporal neighboring blocks as specified in the current disparity vector derivation process. It is reported that the proposed method achieves a coding gain about 0.2% BD-rate saving for coded texture views.

# Introduction

In the current 3D-HEVC [1], a disparity vector (DV) is derived using disparity motion vectors in spatial and temporal neighboring blocks, and derived disparity vectors (DDV) in the spatial neighboring blocks. Pre-defined neighboring blocks and temporal reference frame candidates are checked in order. Specifically, five spatial neighboring block positions in the order of the left, above, above-right, left-below, and above-left, followed by two temporal neighboring block positions (i.e. the blocks at the center and the bottom right positions of a co-located PU) in up to two reference pictures [2, 3, 4] are checked. If a disparity motion vector is found, the derivation process is finished, and the disparity motion vector becomes a DV. Otherwise, the DDV blocks may be further examined.

The DV may be used for an estimator of displacement between two blocks in inter-view residual prediction and inter-view motion prediction, and the displacement is supposedly steady in local by camera positions. However, in the current NBDV derivation process, one can suppose a DV converted from an outlying disparity motion vector, which could be found earlier than any other candidates in the checking order, but the outlier may not serve as a good predictor. Hence, applying a smoothing process in the derivation is feasible, so that the DV becomes more consistent with other neighboring disparity motion vectors. This is accomplished by using multiple disparity motion vectors in neighboring blocks.

# Proposal

This proposal presents a method to improve the NBDV by employing multiple disparity motion vectors in the derivation process. The overall procedure is summarized in Figure 1. As shown, the proposed method mainly has two-step procedures, i.e., a searching phase of non-zero disparity motion vectors in spatial and temporal neighboring blocks, and a decision phase applying mathematical functions. If there is no searched disparity motion vector in the first phase, the DDV is further checked as in the current design. More details are explained in sequel.



## Figure 1: Flow chart of the proposed method

## Searching of disparity vector candidates

Denote a non-zero disparity motion vector searched in a spatial neighboring position by spatial disparity vector candidates (SDVC), and a non-zero disparity motion vector searched in a temporal neighboring position by temporal disparity vector candidates (TDVC).

The proposed derivation process checks the same pre-defined block positions as the current design, and constructs the SDVC and TDVC lists. Each available candidate is inserted to the corresponding candidate list until the searching phase is finished, if one of the following conditions is true:

* The number of the collected disparity vector candidates exceeds a threshold set equal to 3.
* All pre-defined blocks are checked.

## Mathematical function applied to multiple candidates

Simple mathematical functions concerning computational complexity is used to derive a disparity vector by using the constructed SDVC and TDVC lists. In principle, both SDVC and TDVC are considered together as inputs for the mathematical functions to derive the final one. However, if there are insufficient numbers of disparity motion vectors in SDVC (or TDVC), the other vectors in TDVC (or SDVC) is taken account. Meanwhile, based on the total number of the searched disparity vector candidates, the derivation process has some variations in the function. The following scenario is considered.

1. If the total number of the SDVC and the TDVC is more than or equal to three, median function with three inputs is applied where the first two TDVC and one SDVC are used. However, there are not enough TDVC (or SDVC), the available SDVC (or TDVC) are used instead.
2. If the total number of the SDVC and the TDVC is equal to two, a larger one of the first available TDVC and SDVC is chosen as the final DV. However, if none of the SDVC is available, two TDVC becomes the inputs, and vice versa.
3. If there is only one disparity motion vector searched, it becomes the DV.

In all the procedures, only x-components of the disparity motion vectors are taken into account. That is, the horizontal components of the candidates become the input arguments of the component-wise functions. After we pick one horizontal component with the functions among the candidates, the corresponding vertical component and reference view order index are identified to complete a DV.

We also take care of a reference view order index of the DV in the derivation process even though the view order index is always equal to 0 in the common test condition (CTC). However, it matters when the disparity motion vector candidates point different views in some non-CTC scenarios. Therefore, in this proposal, we apply the component-wise functions only if all the reference view order indices are the same among the candidates. Otherwise, the final DV is set to the first candidate in the list with its associated reference view order index.

It is noticed that the proposed method gives relatively minor changes in implementation and the working draft text, and does not need other view components (e.g. a depth map in another view) to enhance the accuracy of the DV.

# Experimental results

Simulation results of the proposal are shown in Table 1. The implementation was based on HTM5.0.1, and simulations are done under common test conditions [5].

As shown in Table 1, the proposed algorithm achieves coding gain, i.e., 0.2% BD-rate reduction for video-only, and the changes in encoding/decoding time are minor.

**Table 1: Proposed algorithm VS HTM5.0.1.**



# References

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# Patent rights declaration(s)

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