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| **Joint Collaborative Team on 3D Video Coding Extensions**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  7th Meeting: San José, US, 11–17 Jan. 2014 | Document: JCT3V-G0033 |

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| *Title:* | **CE4-related: ARP simplification** | | |
| *Status:* | Input Document to JCT-3V | | |
| *Purpose:* | Proposal | | |
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# Abstract

This proposal presents an ARP simplification. In ARP, the number of motion compensation (MC) is three times more than the the number in normal MC. Specifically one MC for predictor and two MC for residual derivation is needed for LX luma, cb and cr component. Although, in pixels basis, the memory access and operation is not so high in courtesy of bi-linier compensation usage, in real case the time of the access / operation is not proportional to the number of pixels. Considering this, it is proposed to omit chroma residual prediction in 4x4 chroma block to reduce the worst case complexity.

The experiment result shows that the BD-rate gain is 0.0 %, 0.0 % and 0.0 % in video, total video and synthesis respectively.

# Introduction

In ARP, we need three MC operations per unit, where each MC operation needs external memory access. This MC operation and the associated memory access is carried out for each colour components. By utilizing bi-prediction compensation, the number of memory access in pixel basis or operations is significantly reduced so that the number is comparable to 8 tap / 4tap motion compensation case in HEVC version 1. However, there exists overhead of MC and memory access. For example, loading filter coefficients, request of memory fetch and waiting for requested data. We asserted the worst case should be considered again, considering the practical cost is not the same as the ideal cost (the number of access in pixel and operation) and the cost can be dependent of system

# Proposal

The contribution proposes to omit chroma residual prediction in 4x4 chroma block. Table 1 shows the comparison of number of motion compensation in 8x8 PU.

Table 1 Comparison of number of access / operation in unit in 8x8 PU

|  |  |  |  |
| --- | --- | --- | --- |
|  | Luma | Chroma | Total |
| HTM9 | 3 | 3\*2 | 9 |
| Proposal | 3 | 1\*2 | 5 |

# Proposed Text

If nPbW is greater than 8,the modified prediction samples predSamplesLXCb[ x ][ y ] with x = 0..( nPbW /2 ) − 1 and y = 0..( nPbH /2 )−1 are derived as specified in the following:

* 1. predSamplesLXCb[ x ][ y ] = predSamplesLXCb[ x ][ y ] +   
      ( ( currIvSamplesLXCb[ x ][ y ] − refIvSamplesLXCb[ x ][ y ] )  >>  shiftVal ) (‑242)

If nPbW is greater than 8, the modified prediction samples predSamplesLXCr[ x ][ y ] with x = 0..( nPbW /2 ) − 1 and y = 0..( nPbH /2 ) − 1 are derived as specified in the following:

* 1. predSamplesLXCr[ x ][ y ] = predSamplesLXCr[ x ][ y ] +   
      ( ( currIvSamplesLXCr[ x ][ y ] − refIvSamplesLXCr[ x ][ y ] )  >>  shiftVal ) (‑243)

# Simulation results

Experiment result based on HTM90r1 is shown in Table 2

Table 1 Experimental results (anchor: HTM90r1)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.0% | 0.4% | 0.4% | 0.13% | 0.12% | 0.05% | 100.5% | 98.6% | 100.1% |
| Kendo | 0.0% | 0.2% | 0.1% | 0.03% | 0.02% | 0.02% | 98.3% | 103.2% | 101.1% |
| Newspaper\_CC | 0.0% | 0.2% | 0.1% | 0.05% | 0.03% | 0.04% | 98.4% | 98.5% | 99.3% |
| GT\_Fly | 0.0% | 0.0% | 0.1% | 0.00% | 0.00% | -0.03% | 99.9% | 99.1% | 99.9% |
| Poznan\_Hall2 | 0.0% | -0.1% | 0.1% | 0.02% | 0.01% | 0.07% | 99.9% | 99.1% | 99.4% |
| Poznan\_Street | 0.0% | 0.0% | 0.0% | -0.01% | -0.01% | -0.01% | 100.4% | 99.4% | 100.0% |
| Undo\_Dancer | 0.0% | -0.1% | -0.1% | -0.01% | -0.01% | -0.03% | 100.1% | 100.8% | 100.4% |
| Shark | 0.0% | 0.1% | 0.1% | 0.02% | 0.00% | 0.02% | 99.6% | 101.3% | 100.4% |
| 1024x768 | 0.0% | 0.2% | 0.2% | 0.07% | 0.06% | 0.04% | 99.1% | 100.1% | 100.2% |
| 1920x1088 | 0.0% | 0.0% | 0.0% | 0.00% | 0.00% | 0.01% | 100.0% | 99.9% | 100.0% |
| **average** | **0.0%** | **0.1%** | **0.1%** | **0.03%** | **0.02%** | **0.02%** | **99.6%** | **100.0%** | **100.1%** |

# Conclusion

This proposal omits residual predition in 4x4 chroma block. Because it removes the worst case concerns with negligible impact, it is recommended to adopt this method in 3D-HEVC.

# Patent rights declaration(s)

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