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| *Title:* | **TE5: Experimental Results of TE5.1.5** | | |
| *Status:* | Input Document to JCT-VC | | |
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# Abstract

This document presents the experimental results for 5.1.5 of Tool Experiment 5 in JCTVC-K1105. Two approaches base layer-based MPM coding (BL-MPM) and inter-layer intra prediction mode coding (ILIPM) have been proposed in JCTVC-K0238. The proposed approaches utilize the base layer intra prediction mode to improve the coding efficiency of the CUs not being coded by Intra\_BL in the context of the scalable HEVC coding. The implementations were integrated into the Smuc 0.1.1 software. Compared to enhancement layer only of anchor in TE 5.1, it reports that BL-MPM achieves average luma BD-rate gains of 0.2% for All Intra HEVC 2x spatial scalability, 0.1% for All Intra HEVC 1.5x spatial scalability. For ILIPM, it reportedly shows average luma BD-rate gains of 0.1% for All Intra HEVC 2x spatial scalability, 0.0% for All Intra HEVC 1.5x spatial scalability.

# Introduction

In JCTVC-K0238 [1], two approaches to improve the intra prediction mode coding in the enhancement layer have been proposed. BL-MPM introduces a new flag bl\_mode\_mpm\_flag to indicate whether the intra prediction mode of the co-located PU in the base layer is used as the intra prediction mode of the current PU in the enhancement layer. The bl\_mode\_mpm\_flag is coded in the coding unit syntax only if prev\_intra\_luma\_pred\_flag is false. If the encoder cannot find a matched intra prediction mode in the list of 3MPM candidates for the current PU, prev\_intra\_luma\_pred\_flag is set to false and the intra prediction mode of the co-located PU in the base layer is checked whether it is equal to the intra prediction mode of the current PU in the enhancement layer. If the intra prediction mode of the current PU is equal to the intra prediction mode of the co-located PU in the base layer, bl\_mode\_mpm\_flag is set to true and rem\_intra\_luma\_pred\_mode does not need to be coded any more. Otherwise, Bl\_mode\_mpm\_flag is set to false and rem\_intra\_luma\_pred\_mode is coded as the single layer HEVC coding.

Alternatively, IPILM introduces a flag intra\_bl\_mode\_flag before prev\_intra\_luma\_pred\_flag in the coding unit syntax. Intra\_bl\_mode\_flag is only coded in the coding unit syntax if the following condition is true,

( ( 1 << log2CbSize\_enh ) >> trafoDepth = = (( 1 << log2CbSize\_base ) >> trafoDepth ) << 1)

Intra\_bl\_mode\_flag is to indicate whether the intra prediction mode of the current PU is equal to the intra prediction mode of the co-located PU in the base layer. If intra\_bl\_mode\_flag is true, prev\_intra\_luma\_pred\_flag and rem\_intra\_luma\_pred\_mode are not coded any more. Otherwise, MPM coding as in the single layer HEVE coding is performed.

# Experimental Results

Test sequences and coding condition as shown in [2], were used to evaluate the performance of the proposed approaches. Smuc 0.1.1 was used as the anchor. The encoding and decoding test were conducted on a Linux cluster with Intel Xeon CPU X5670, 2.93GHz. The encoder and decoder binaries were compiled with gcc 4.1.2 64-bit. Both the proposed encoder/decoder and anchor encoder/decoder were tested in the same cluster. The average performances of the proposed approaches are shown in the following tables. The detailed results can be found in the enclosed excel sheets.

## BL-MPM vs. anchor (Intra\_BL)

In Table 1, the average performance of the proposed BL-MPM vs. anchor is provided.

Table Performance of BL-MPM compared to anchor of TE 5.1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **AI HEVC 2x** | | | **AI HEVC 1.5x** | | |
|  | Y | U | V | Y | U | V |
| Class A | -0.1% | 0.0% | 0.0% |  |  |  |
| Class B | -0.1% | -0.1% | -0.1% | -0.1% | 0.0% | 0.0% |
| **Overall (EL+BL)** | -0.1% | -0.1% | -0.1% | -0.1% | 0.0% | 0.0% |
| **Overall (EL)** | -0.2% | -0.1% | -0.1% | -0.1% | 0.1% | 0.1% |
| Enc Time[%] | 102.3% | | | 101.5% | | |
| Dec Time[%] | 99.8% | | | 100.2% | | |
| Enc Mem[%] | #DIV/0! | | | #DIV/0! | | |
| BL Match | Matched | | | Matched | | |

## ILIPM vs. anchor (Intra\_BL)

In Table 2, the average performance of the proposed ILIPM vs. anchor is provided.

Table Performance of ILIPM compared to anchor of TE 5.1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **AI HEVC 2x** | | | **AI HEVC 1.5x** | | |
|  | Y | U | V | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% |  |  |  |
| Class B | -0.1% | -0.1% | -0.1% | 0.0% | 0.0% | 0.0% |
| **Overall (EL+BL)** | 0.0% | -0.1% | -0.1% | 0.0% | 0.0% | 0.0% |
| **Overall (EL)** | -0.1% | -0.1% | -0.1% | 0.0% | -0.1% | 0.0% |
| Enc Time[%] | 102.6% | | | 101.8% | | |
| Dec Time[%] | 101.4% | | | 101.3% | | |
| Enc Mem[%] | #DIV/0! | | | #DIV/0! | | |
| BL Match | Matched | | | Matched | | |

# Reference

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| [1] | Z. Zhao, J. Si and J. Ostermann, "Inter-layer intra prediction mode coding for the scalable extension of HEVC," JCTVC-K0238, Shanghai, 2012. |
| [2] | V. Seregin, P. Onno, S. Liu, T. Lee, C. Kim and H. Yang, "Description of Tool Experiment C5: Inter-layer syntax prediction using HEVC base layer," JCTVC-K1105, 2012. |

# Patent rights declaration(s)

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