|  |  |
| --- | --- |
| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11**  7th Meeting: Geneva, CH, 21-30 November, 2011 | Document: JCTVC-G992 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Cross-check of JCTVC-G530-- Layered quantization matrices compression** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
| *Author(s) or Contact(s):* | Ximin Zhang  Shan Liu 2860 Junction Ave.  San Jose, CA95134, USA | *Emails:* | [ximin.zhang@mediatek.com](mailto:ximin.zhang@mediatek.com)  shan.liu@mediatek.com |
| *Source:* | MediaTek USA Inc. | | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Abstract

The document reports cross-check results for proposal JCTVC-G530, “Non-CE4: Layered quantization matrices compression”. The BD rate performance for All Intra, Random Access, Low Delay B and Low Delay P has been verified. The source code has also been checked and compiled. No issue is reported.

# Introduction

Proposal JCTVC-G530 [2] proposed a layered coding structure for quantization matrix compression and reused some tools in [4] to further improve the compression performance. The compress ratio is increased comparing to AVC method under the test condition of CE4 [5]. The proposed layered coding structure is a one-pass coding method.

# Performance results of the proposed method

The proposed method from JCTVC-G530 was built on CE4 distributed HM 4.0 software. For this cross verification, simulations using software provided by the proponents were compared to a reference coded with AVC method in the CE4 distributed HM 4.0 software, using the common conditions described in [3][5]. The compression results for symmetrical quantization matrix are shown in Table 1. The results of asymmetrical quantization matrix are shown in Table 2. The proposed method can be turned on with

#define HS\_QM 1

Table 1: BD-Rate for symmetrical quantization matrix compression.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  | **All Intra HE** | | | **All Intra LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A | -1.7% | -3.1% | -2.9% | -3.7% | -8.0% | -7.4% |
|  | Class B | -6.3% | -6.7% | -6.6% | -7.3% | -10.0% | -9.9% |
|  | Class C | -15.5% | -15.9% | -16.3% | -15.1% | -16.3% | -16.9% |
|  | Class D | -34.6% | -34.1% | -34.4% | -33.4% | -33.6% | -33.8% |
|  | Class E | -19.0% | -19.2% | -18.0% | -18.7% | -21.8% | -21.2% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -14.8% | -15.2% | -15.1% | -15.1% | -17.3% | -17.3% |
|  |  | -14.8% | -15.2% | -15.2% | -15.1% | -17.4% | -17.4% |
|  | Enc Time[%] | 100% | | | 97% | | |
|  | Dec Time[%] | 100% | | | 99% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Random Access HE** | | | **Random Access LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A | -19.4% | -19.0% | -18.6% | -19.0% | -17.7% | -16.3% |
|  | Class B | -37.6% | -35.0% | -33.9% | -36.1% | -33.4% | -32.4% |
|  | Class C | -56.8% | -55.1% | -55.3% | -55.8% | -54.2% | -54.4% |
|  | Class D | -79.2% | -77.8% | -78.0% | -78.6% | -77.5% | -77.7% |
|  | Class E |  |  |  |  |  |  |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -47.6% | -46.0% | -45.7% | -46.7% | -45.0% | -44.4% |
|  |  | -47.8% | -46.1% | -45.9% | -46.9% | -45.0% | -44.5% |
|  | Enc Time[%] | 100% | | | 100% | | |
|  | Dec Time[%] | 99% | | | 99% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Low delay B HE** | | | **Low delay B LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A |  |  |  |  |  |  |
|  | Class B | -39.9% | -36.6% | -36.0% | -38.7% | -35.4% | -35.1% |
|  | Class C | -57.3% | -54.8% | -55.2% | -56.5% | -54.3% | -55.0% |
|  | Class D | -79.0% | -77.3% | -77.4% | -78.6% | -77.0% | -77.5% |
|  | Class E | -82.4% | -80.0% | -80.6% | -81.1% | -78.4% | -79.3% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -62.0% | -59.5% | -59.5% | -61.1% | -58.6% | -59.0% |
|  |  | -62.0% | -59.6% | -59.6% | -61.1% | -58.6% | -59.0% |
|  | Enc Time[%] | 100% | | | 100% | | |
|  | Dec Time[%] | 99% | | | 99% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Low delay P HE** | | | **Low delay P LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A |  |  |  |  |  |  |
|  | Class B | -38.8% | -35.9% | -35.0% | -37.4% | -34.4% | -33.9% |
|  | Class C | -56.6% | -54.1% | -54.3% | -55.7% | -53.6% | -54.3% |
|  | Class D | -78.5% | -76.5% | -77.0% | -78.2% | -76.3% | -76.9% |
|  | Class E | -81.8% | -79.3% | -80.0% | -80.3% | -77.8% | -78.6% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -61.2% | -58.7% | -58.7% | -60.2% | -57.8% | -58.1% |
|  |  | -61.2% | -58.8% | -58.9% | -60.2% | -57.9% | -58.2% |
|  | Enc Time[%] | 100% | | | 99% | | |
|  | Dec Time[%] | 99% | | | 99% | | |

Table 2: BD-Rate for Asymmetrical quantization matrix compression.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **All Intra HE** | | | **All Intra LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A | -1.5% | -5.2% | -4.4% | -4.3% | -10.7% | -11.5% |
|  | Class B | -6.0% | -6.2% | -5.9% | -8.0% | -10.5% | -11.8% |
|  | Class C | -16.6% | -14.3% | -14.3% | -17.0% | -15.1% | -16.3% |
|  | Class D | -34.5% | -31.3% | -31.5% | -33.8% | -30.9% | -31.4% |
|  | Class E | -18.7% | -19.8% | -19.1% | -19.0% | -22.3% | -22.9% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -14.8% | -14.7% | -14.4% | -15.9% | -17.3% | -18.2% |
|  |  | -14.8% | -14.8% | -14.5% | -15.9% | -17.4% | -18.3% |
|  | Enc Time[%] | 100% | | | 97% | | |
|  | Dec Time[%] | 99% | | | 98% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Random Access HE** | | | **Random Access LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A | -20.2% | -19.9% | -19.3% | -20.0% | -19.9% | -18.9% |
|  | Class B | -37.2% | -33.9% | -32.8% | -35.8% | -32.9% | -32.0% |
|  | Class C | -56.6% | -53.7% | -53.8% | -55.5% | -52.7% | -52.9% |
|  | Class D | -78.6% | -76.8% | -76.8% | -77.9% | -76.2% | -76.3% |
|  | Class E |  |  |  |  |  |  |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -47.5% | -45.4% | -45.0% | -46.6% | -44.7% | -44.3% |
|  |  | -47.6% | -45.4% | -45.1% | -46.7% | -44.7% | -44.3% |
|  | Enc Time[%] | 100% | | | 99% | | |
|  | Dec Time[%] | 99% | | | 99% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Low delay B HE** | | | **Low delay B LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A |  |  |  |  |  |  |
|  | Class B | -39.1% | -35.3% | -34.5% | -38.7% | -35.4% | -33.9% |
|  | Class C | -56.6% | -53.8% | -53.7% | -55.7% | -53.4% | -53.2% |
|  | Class D | -78.3% | -76.5% | -76.2% | -77.7% | -76.2% | -76.0% |
|  | Class E | -82.4% | -79.9% | -79.8% | -81.0% | -78.9% | -79.4% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -61.4% | -58.6% | -58.2% | -60.6% | -58.2% | -57.8% |
|  |  | -61.4% | -58.7% | -58.4% | -60.6% | -58.3% | -57.9% |
|  | Enc Time[%] | 100% | | | 99% | | |
|  | Dec Time[%] | 99% | | | 99% | | |
|  |  |  |  |  |  |  |  |
|  |  | **Low delay P HE** | | | **Low delay P LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A |  |  |  |  |  |  |
|  | Class B | -38.0% | -34.5% | -33.7% | -37.3% | -34.4% | -33.0% |
|  | Class C | -55.7% | -52.9% | -52.9% | -54.9% | -52.4% | -52.3% |
|  | Class D | -77.6% | -75.9% | -75.8% | -77.1% | -75.4% | -75.2% |
|  | Class E | -81.8% | -79.3% | -79.3% | -80.2% | -78.2% | -78.7% |
|  | Class F |  |  |  |  |  |  |
|  | **Overall** | -60.5% | -57.9% | -57.6% | -59.7% | -57.4% | -56.9% |
|  |  | -60.5% | -58.0% | -57.8% | -59.7% | -57.4% | -57.1% |
|  | Enc Time[%] | 100% | | | 99% | | |
|  | Dec Time[%] | 99% | | | 99% | | |

# Summary

The results obtained during this cross checking match those provided by the proponents. Examination of the software confirms that it is indeed conduct the compression described in the proposal. Run times for the proposed tool are on par with the results in JCTVC-530 allowing for minor variations due to the computer cluster computing.

# References

1. B. Bross, et al., “WD4: Working Draft 4 of High-Efficiency Video Coding,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, JCTVC-F803\_d5, Torino, IT, July 2011.
2. Y. Wang, J. Zheng, X. Zheng, Y. He, “Non-CE4: Layered quantization matrices compression,” Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, JCTVC-G530, Geneva, CH, November 2011.
3. F. Bossen., “Common conditions and software reference configurations”, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, JCTVC-F900, Torino, IT, July 2011.
4. J.Tanaka, Y.Morigami,T.Suzuki, “Enhancement of quantization matrix coding for HEVC” in JCTVC-F475, Torino, IT, July. 2011.
5. K.Sato, “Description of Core Experiment 4 (CE4): Quantization,” JCTVC-F904, Torino, IT, July. 2011.

# Patent rights declaration(s)

**MediaTek Inc. may have IPR 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).**