|  |  |
| --- | --- |
| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  31st Meeting: San Diego, US, 13–20 Apr. 2018 | Document: JCTVC-AE0029-v1 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Report on the performance of raster search in HM** | | |
| *Status:* | Input document to JCT-VC | | |
| *Purpose:* | Report | | |
| *Author(s) or Contact(s):* | Sang-hyo Park Barun ICT Research Center, 50 Yonsei-ro, Seodaemun-gu,  Seoul, South Korea, 03722 | Email: | spark@barunict.kr |
| *Source:* | Yonsei University | | |

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

# Abstract

This contribution reports the performance change in HM with 4:2:0 test condition when raster search is turned off. When turning it off, a 0.2 % increase for RA case and a 0% increase for LD case were reported on average in Y BD-rate. At the same time, turning off raster search reduced the encoding time to 90 % for RA and 98% for LD, on average, in comparison with HM 16.18.

# Introduction

Encoding complexity of HM has been researched and attempted to be reduced in literature. In addition, HM encoding may be needed when comparing the performance improvement from HM to JEM in literature as well as in the standardization process of future video coding. Accordingly, decreasing the encoding complexity of HM can save time for reporting such evaluation experiments.

In this context, a simple parameter evaluation was conducted and reported in this contribution. One of the recent changes that can increase the encoding complexity of HM was evaluated: search range. To be specific, search range has been increased from 64 to 256, and currently 384 for random access (RA) main configuration. The next section briefly review the motion search process in the latest HM and point a room to be improved in view of encoding complexity.

# Search process in HM 16.18

There are several cases that HM 16.18 can choose to search integer-pixel motion vector. The default option in HM has been diamond search (i.e., MESEARCH\_DIAMOND in source code) which uses diamond search pattern as written in Subsection 6.5.2.2.1 in JCTVC-AB1002. In addition to the diamond search, HM default option is conducting raster search when the result of diamond search is far from the starting point. Raster search “tests blocks along a sparse grid within the defined search window, testing blocks at every five luma samples horizontally and vertically” as written in JCTVC-AB1002.

Although the search range was increased from 64 (HM 16.13) to 384 (HM 16.16 and later) for RA case, the number of search point for diamond search may not be increased in the certain situation. It is possible because for the first diamond search, there exist stop criterion that determine the best search point and skip remaining points upon the given small distance. However, there is no such stop criterion on raster search when it is enabled and the best distance of the first diamond search is longer than five.

To figure out a room to reduce the encoding complexity of raster search, the encoding time of two sets were measured on top of HM 16.18: 1) default search option and 2) turning off raster search. The following section describes the test condition and experimental results.

# Experiments

Tests were conducted based on common test conditions (CTCs) in JCTVC-AC1100, but class A and class F sequences were not tested in this contribution. As an initial report for the performance check of raster search in HM 16.18, two configurations were selected in HM 4:2:0 CTCs: RA main and LB main. Test material in this experiments is Class B, Class C, Class D, and Class E. Overall results for RA is shown in Table 1, and results for LD in Table 2. Detailed data is in the attached excel sheet. For RA case, it was reported on average that a 0.2% increase was occurred in BD-rate of Y and a 10% decrease was occurred in encoding time, when raster search was turned off. For LD case, it was reported on average that a 0.0% increase was occurred in BD-rate of Y and a 2% decrease was occurred in encoding time, when raster search was turned off.

**Table 1.** BD-rates of raster search off against HM 16.18 in RA case

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Random Access Main** | | |
|  | Y | U | V |
| Class A | #REF! | #REF! | #REF! |
| Class B | 0.2% | 0.3% | 0.3% |
| Class C | 0.3% | 0.4% | 0.5% |
| Class D | 0.1% | 0.1% | 0.1% |
| Class E |  |  |  |
| **Overall** | 0.2% | 0.3% | 0.3% |
| Enc. Time | 90% | | |

**Table 2.** BD-rates of raster search off against HM 16.18 in LB case

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Low delay B Main** | | |
|  | Y | U | V |
| Class A |  |  |  |
| Class B | 0.0% | 0.0% | -0.2% |
| Class C | 0.1% | 0.1% | 0.1% |
| Class D | 0.0% | 0.0% | -0.1% |
| Class E | 0.0% | 0.0% | -0.5% |
| **Overall** | 0.0% | 0.0% | -0.2% |
| Enc. Time | 98% | | |

# Patent rights declaration(s)

**Yonsei University does not have any current or pending patent rights relating to the technology described in this contribution.**