|  |  |
| --- | --- |
| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  19th Meeting: Strasbourg, FR, 17–24 Oct. 2014 | Document: JCTVC-S0075 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Copy Mode for Static Screen Content** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | T. Laude (Leibniz Universitaet Hannover)  Institut fuer Informationsverarbeitung Leibniz Universitaet Hannover Appelstrasse 9a  30167 Hannover  Germany | Tel: Email: | +49 511 762 19588 [laude@tnt.uni-hannover.de](mailto:laude@tnt.uni-hannover.de) |
| *Source:* | Institut fuer Informationsverarbeitung, Leibniz Universitaet Hannover | | |

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

# Abstract

This contribution presents a copy mode which reportedly aims at the coding of static screen content. In particular, it is reported that the sample values of a block coded with the copy mode are reconstructed by copying the sample values from the corresponding block at the same position in the closest reference picture. Furthermore, it is asserted that the copy mode is only applied on CTU level. The contribution states that Y/G BD-rate changes of {-0.2%, 0.0%, -0.5%, -0.6%, 0.0%, 0.0%, -0.2%, -0.3%, -0.6%, -1.0%, 0.1%, 0.0%} and {0.0%, 0.0%, -0.2%, -0.1%, 0.0%, 0.0%, 0.0%, -0.1%, -0.1%, -0.1%, 0.1%, 0.0%} are achieved for LD and RA compared to SCM-2.0 under SCC common test conditions.

# Introduction

A typical characteristic of screen content videos is the absence of changes between consecutive frames or parts of these frames. One possible scenario where such unchanged areas may appear is static background in screen content.

Although the merge/skip mode of HEVC can be used to describe these unchanged areas efficiently, the signaling overhead for e.g. a skip flag and a merge index may not be negligible considering the low bit rates achieved for screen content videos. In order to reduce the signaling overhead, a coding mode called “copy mode” is proposed. The copy mode reconstructs the sample values of the current coding unit (CU) by copying the sample values from the CU located at the same position in the closest reference picture.

The comparison between the skip mode and the copy mode in Figure 1 shows that in contrast to the skip mode, where it is necessary to signal which of the merge candidates is used for the current CU, no side information beside the copy mode usage itself is required for the copy mode since there is only one possible candidate, the zero motion vector to the closest reference frame. Therefore, only one binary flag is needed to signal the copy mode usage, compared to two syntax elements (skip\_flag and merge\_index) needed for the skip mode.



Figure 1: Comparison between skip mode and copy mode

Taking into account, that typically larger CUs are used to code unchanged areas while smaller CU sizes are used to code areas with lots of changes, the copy mode is only applied on coding tree unit (CTU) level for the experimental results of this proposal. Thus, the copy mode can be applied to the large CTUs in unchanged areas while no unnecessary signaling overhead is caused for small CU sizes in areas where the copy mode cannot be applied efficiently anyway.

# Text specification

Table 1 shows the signaling of the copy mode flag as part of the CU syntax. Changes relative to the latest SCC draft [1] are highlighted in yellow. It is worth noting, that for the results of this contribution, the cu\_copy\_flag is only signaled on CTU level while the syntax element is not present for CUs of other depths where cu\_copy\_flag is inferred as equal to 0 instead.

Table 1: Coding unit syntax

|  |  |
| --- | --- |
| coding\_unit( x0, y0, log2CbSize ) { | Descriptor |
| **cu\_copy\_flag**[ x0 ][y0] | ae(v) |
| if ( !cu\_copy\_flag[ x0 ][ y0] ) { |  |
| if( transquant\_bypass\_enabled\_flag ) |  |
| **cu\_transquant\_bypass\_flag** | ae(v) |
| if( slice\_type != I ) |  |
| **cu\_skip\_flag**[ x0 ][ y0 ] | ae(v) |
| … |  |
| } |  |
| } |  |

# Experimental results

The copy mode has been implemented in the SCM-2.0 reference software, which is used as anchor, and evaluated under common test conditions [2]. Since the method is an inter method, no results are reported for the all-intra configuration. Runtimes are not reliable. However, all simulations have been executed on a homogeneous cluster.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p | 0.0% | 0.1% | 0.1% |
| RGB, text & graphics with motion,720p | 0.0% | 0.0% | 0.0% |
| RGB, mixed content, 1440p | -0.2% | -0.1% | -0.2% |
| RGB, mixed content, 1080p | -0.1% | -0.1% | -0.1% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | 0.0% | 0.1% | 0.1% |
| YUV, text & graphics with motion,720p | -0.1% | 0.0% | 0.0% |
| YUV, mixed content, 1440p | -0.1% | -0.1% | -0.1% |
| YUV, mixed content, 1080p | -0.1% | -0.1% | -0.1% |
| YUV, Animation, 720p | 0.1% | 0.0% | 0.2% |
| YUV, camera captured, 1080p | 0.0% | 0.2% | 0.0% |
| Enc Time[%] | 101% | | |
| Dec Time[%] | 87% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p | -0.2% | -0.2% | -0.1% |
| RGB, text & graphics with motion,720p | 0.0% | -0.1% | 0.0% |
| RGB, mixed content, 1440p | -0.5% | -0.4% | -0.4% |
| RGB, mixed content, 1080p | -0.6% | -0.2% | -0.4% |
| RGB, Animation, 720p | 0.0% | 0.3% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | -0.2% | -0.1% | -0.1% |
| YUV, text & graphics with motion,720p | -0.3% | -0.1% | -0.6% |
| YUV, mixed content, 1440p | -0.6% | -0.3% | -0.5% |
| YUV, mixed content, 1080p | -1.0% | -1.0% | -0.7% |
| YUV, Animation, 720p | 0.1% | 0.1% | 0.3% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.1% |
| Enc Time[%] | 104% | | |
| Dec Time[%] | 93% | | |

# References

[1] R. Joshi and J. Xu, *JCT-VC R1005: High Efficiency Video Coding (HEVC) Screen Content Coding: Draft 1. 18th Meeting of the Joint Collaborative Team on Video Coding (JCT-VC), Sapporo, JP, 30 June - 9 July*. 2014.

[2] H. Yu, R. Cohen, K. Rapaka, and J. Xu, *JCT-VC R1015: Common Test Conditions for Screen Content Coding. 18th Meeting of the Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11. Sapporo, JP*. 2014.

# Patent rights declaration(s)

**Institut fuer Informationsverarbeitung, Leibniz Universitaet Hannover may have current or pending patent rights 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).**