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| *Title:* | **Unification of the Availability Checking method for Intra prediction** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

In this contribution, the unification of the availability checking methods is presented. The different available checking methods are used whether the CIP (Constrained Intra Prediction) on or not in the current HM. This contribution unifies these different checking methods. The result is shown that this contribution keeps the same checking method without performance degradation.

# Introduction

In the previous meeting, the padding method for unavailable reference samples for intra prediction (JCTVC-E488)[1] were adopted in current HM in case of CIP on. Thus, there are different methods to check availability for reference samples; one is to check it by minimum PU size when CIP is on, the other is to do the same work by the current PU size when CIP is off.

Therefore, there are several considerations as mentioned below:

(1) Even though there are available sample in the near of boundary which is less than the current PU size, these samples are marked as unavailable them in the current HM.

(2) Different availability checking method gives different result of intra prediction, even if the same intra-coding conditions.

Therefore, the consistent design of checking methods regardless of CIP status is needed.



**Figure 1. Availability checking for reference sample in intra slice**



**Figure 2. Padding unavailable reference sample in intra slice**

The slice or picture boundary across on above-right unit is shown in Figure 1. Availability of shaded area is changed whether CIP is on or not. If CIP is off, whole above-right PU are considered unavailable. Finally, whole above-right unit are padded with the red sample which sample whose location on most right in above block in as shown in Figure 2.

When CIP is on, the samples located inside of boundary (shaded area in Figure 1) are considered as available then the only samples placed out sides of boundary are padded with green sample.

When slice width or slice height are not divided by LCU size, this different availability checking situations could arise.

# Proposal methods

We implemented unification of availability of reference samples checking methods where the same methods are used without the status of CIP. The flow chart of availability checking scheme in HM3.0 and proposed one are shown in Figure 3. The “available\_check\_cip ( )” and “available\_check\_intra ( )” are the functions which are selected by the “constrined\_intra\_pred”. The “contrained\_intra\_pred” is the flag which is transmitted in picture parameter set. The “Is\_intra” means that the current block is intra. “Available ( )” is the function that checks whether reference samples are available or not.



**Figure 3. Flow chart of HM3.0 and proposed method**

Since different availability checking between proposed and existing method arise in slice or picture boundary, proposed method will be more important when a picture is partitioned into multiple slices such as FGS(fine granularity slices) [2].

# Test Condition

The proposed unification of the availability checking method implemented into HM3.0 and branch version of HM3.0 (HM3.0\_dev\_mediatek). Simulations were conducted on conditions as specified in JCTVC-D600 [5].

For branch version HM3.0\_dev\_mediatek, follow additional configurations are added.

**SliceGranularity : 2**

**SliceMode : 2**

**SliceArgument : 1500**

The “SliceMode” and “SilceArgument” mean maximum size of a slice is set to 1500bytes. The “SliceGranularity” means minimum size of slice boundary is set to 16x16.

# Experimental Results

The simulation result of propose scheme is shown in Table 1.

**Table 1. Results of proposed scheme compared to HM3.0 anchor**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Intra | | | Intra LoCo | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Class B | 0.00 | 0.00 | -0.01 | 0.00 | -0.01 | 0.00 |
| Class C | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Class D | 0.00 | -0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Class E | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| All | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enc Time[%] | 101% | | | 103% | | |
| Dec Time[%] | 101% | | | 104% | | |

It seems that there is a little effect in this results, because proposed scheme takes effect only in horizontal boundary of Class B(1280x720), Class D(832x480) and Class E(1280x720). However, if a picture is partitioned into multiple slices such as FGS (fine granularity slices), it can arise both horizontal and vertical slice boundary. Therefore, we added simulation at the FGS conditions branch. The simulation results of HM3.0 branch version HM3.0\_dev\_mediatek with FGS (fine granularity slices) is shown in Table 2.

**Table 2. Results of proposed scheme compared to HM3.0\_dev\_mediatek anchor**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Intra | | | Intra LoCo | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | -0.02 | -0.10 | -0.06 | -0.03 | -0.07 | -0.01 |
| Class B | -0.02 | -0.03 | -0.05 | -0.02 | -0.02 | -0.02 |
| Class C | -0.01 | -0.01 | -0.03 | -0.01 | 0.00 | 0.00 |
| Class D | -0.01 | -0.02 | -0.01 | 0.00 | -0.01 | -0.01 |
| Class E | -0.01 | -0.03 | -0.02 | -0.01 | -0.02 | -0.03 |
| All | -0.01 | -0.04 | -0.04 | -0.01 | -0.02 | -0.01 |
| Enc Time[%] | 101% | | | 102% | | |
| Dec Time[%] | 102% | | | 104% | | |

# Conclusion

This proposal presents unification of the availability checking method for Intra prediction. In this proposal, two different availability checking processes for intra prediction are unified without performance degradation. Especially, proposed method has more strong points in the FGS conditions.

# Related Contributions

1. R. Sjöberg, C. Lai, K. Chono, V. Wahadaniah,“BoG report on padding of unavailable reference samples for intra prediction”,JCT-VC document JCTVC-E488, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP3 and ISO/IEC JTC1/SC29/WG11, 5th meeting, Geneva, CH, March 2011.
2. R. Sjöberg,S. Lei, Y. Huang, Q. Shen,” BoG on fine granularity slices”, ,JCT-VC document JCTVC-E483, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP3 and ISO/IEC JTC1/SC29/WG11, 5th meeting, Geneva, CH, March 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-C500, 3rd Meeting: Guangzhou, CN, Oct., 2010.

# Modification of WD

JCTVC-E603\_d8 Section 8.3.3.1

~~The derivation process for neighbouring locations in subclause XXX is invoked for sample location with ( xBN, yBN ) as input and the treeblock address tbAddrN as output~~.

– Each sample p[ x, y ] with x = -1, y= -1..nS\*2-1  and x = 0, y = -1 is derived as follows

* If any of the following condition is true, the sample p[ x, y ] is marked as “not available for intra prediction”
  + ~~tbAddrN~~ the coding unit covering ( xBN, yBN ) is not available
  + the coding unit covering ( xBN, yBN ) is not coded as intra mode and constrained\_intra\_pred\_flag is equal to 1
* Otherwise, the sample p[ x, y ] is marked as “available for intra prediction” and the sample at the location ( xBN, yBN ) ~~inside the treeblock tbAddrN~~ is assigned to p[ x, y ]

# Patent rights declaration(s)

**Samsung Electronics Co., Ltd. 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).**