

JVET-C0061 DECODER-SIDE INTRA MODE DERIVATION

Xiaoyu Xiu, Yuwen He, Yan Ye
InterDigital Communications Inc.
May 2016

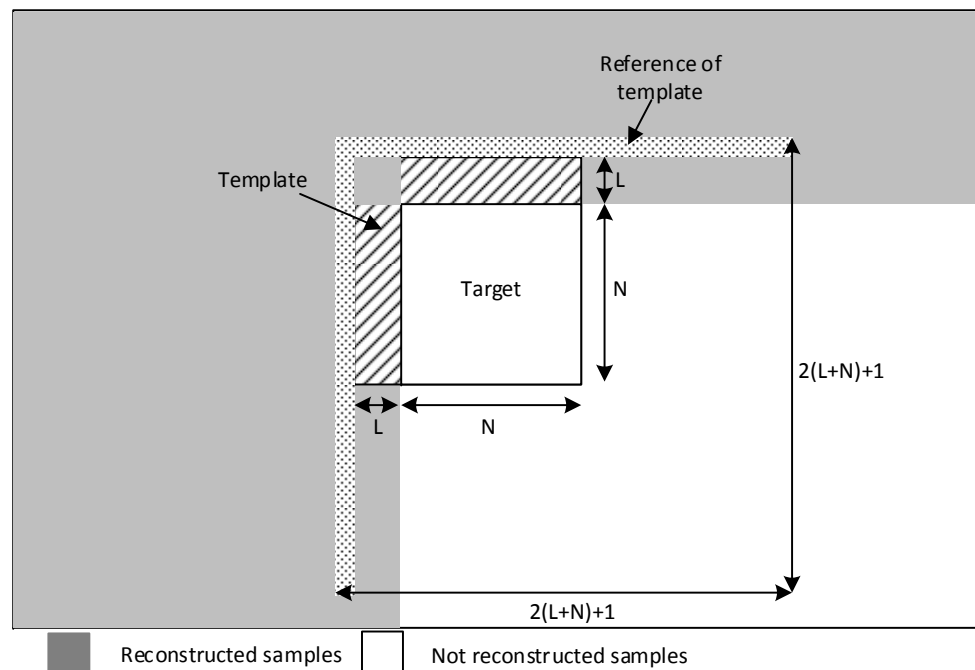


Introduction

- The existing intra prediction in JEM-2.0
 - The number of intra modes are extended from 35 (33 angular directions) to 67 (65 angular directions)
 - Intra modes are derived at encoder and explicitly signaled to decoder
 - The intra mode signaling overhead may take up to 5~10% of overall bitrate
- Proposal
 - Decoder-side intra mode derivation (DIMD) is proposed to derive intra mode at both encoder and decoder
 - The DIMD is used in two ways
 - For $2N \times 2N$ CUs, the DIMD is used as one intra coding mode by signaling a CU-level DIMD flag
 - For $N \times N$ CUs, the DIMD intra mode is used to replace one existing MPM candidate in MPM list
 - Fast algorithm for DIMD search

Template based intra mode derivation

- A template specifies a set of already reconstructed samples and is used to derive the intra mode of the current block
- Template size (L) is 2 for 4x4 and 8x8 blocks and is 4 for 16x16 and larger blocks
- The SAD is calculated between the reconstructed samples and the predicted samples of the template
- The intra mode among all search candidates that yields the minimum SAD is selected



Applying the DIMD to intra coding

- The DIMD for intra $2N \times 2N$ CUs
 - The DIMD is used as one additional intra coding mode by signaling a CU-level DIMD flag
 - When the DIMD is enabled:
 - The CU adaptively decides to derive its intra mode(s) at either PU-level or TU-level
 - Chroma component always reuses the same intra mode derived for luma component, which is equivalent to DM mode
 - The number of intra modes increases to 131, i.e., DC, Planar and 129 angular intra directions
- The DIMD for intra $N \times N$ CUs
 - The DIMD intra mode is used for MPM-based intra mode coding
 - The DIMD candidate is always placed at the first place of the MPM list and the last existing MPM candidate is removed
 - Pruning is performed such that the DIMD candidate is not redundant

Fast DIMD search algorithm

- Initial estimation process
 - It aims at providing a good starting point for intra mode search-
 - A set of 11 initial candidate intra modes, including DC, Planar and every 4-th mode of the 33 HEVC angular intra directions, are tested
 - The intra mode that minimizes the SAD is selected as the starting intra mode
- If the starting intra mode is DC or Planar, the search process is terminated
- Otherwise, one refinement process is performed
 - The center mode is set to the starting intra mode and the search interval is set to 8
 - At each stage, the center mode and two neighboring intra modes separated by the search interval are tested
 - The optimal mode is selected as the new center mode, the search interval is reduced to half, and search is repeated using the new center mode and search interval
 - The final derived intra mode is obtained after 4 search stages are completed

Performance

- Anchor: JEM-2.0
- Test: Anchor + DIMD

	All Intra Main10 Over HM-16.6-JEM-2 (parallel)				
	Y	U	V	EncT	DecT
Class A1	-0.55%	-0.23%	-0.26%	151%	123%
Class A2	-1.03%	-1.19%	-1.31%	155%	132%
Class B	-0.69%	-0.62%	-0.76%	150%	138%
Class C	-0.80%	-0.63%	-0.62%	144%	158%
Class D	-0.58%	-0.19%	-0.36%	141%	169%
Class E	-1.40%	-1.72%	-1.50%	154%	141%
Overall	-0.81%	-0.72%	-0.77%	149%	143%

Performance

- Anchor: HM16.6 parallel encoding/decoding (i.e., JEM-2.0 with all new tools disabled)
- Test: Anchor + DIMD

	All Intra Main10 Over HM-16.6 (parallel)				
	Y	U	V	EncT	DecT
Class A1	-0.90%	-1.09%	-1.28%	148%	127%
Class A2	-2.03%	-2.66%	-2.52%	150%	138%
Class B	-1.16%	-1.49%	-1.49%	148%	142%
Class C	-1.31%	-1.61%	-1.74%	147%	160%
Class D	-0.78%	-1.03%	-1.14%	146%	167%
Class E	-2.31%	-3.49%	-2.97%	146%	135%
Overall	-1.37%	-1.81%	-1.80%	148%	144%

Closing remarks

- The DIMD algorithm is proposed to reduce the overhead of intra mode signaling
- Different approaches are proposed to apply the DIMD to intra coding
- Fast DIMD search algorithm is proposed
- Coding gains: 0.81% and 1.37% AI BD-rate savings for JEM-2.0 and HM-16.6
- Recommend to integrate the proposed tool to the next release of the JEM software

Thanks Huawei for cross-checking!
(JVET-C0094)