

Sub-8x8 PU coding with fixed reference index

JCTVC-F070

Minhua Zhou

(Texas Instruments Inc., USA)

Summary

- Proposal
 - Fix reference index to ZERO for 8x4, 4x8, and 4x4 PUs
- Motivation
 - Reduce memory bandwidth for motion compensation
- Results
 - Average loss: 0.3% RA-HE, 0.5% RA-LC, 0.2% LB-HE and 0.4% LB-LC
- Recommendation
 - Further study on this topic for reduction of memory bandwidth requirements of motion compensation.

Motivations

- Memory bandwidth is increasingly a bottleneck for HD chip designs
 - Video resolution increases much faster than DDR bandwidth growth
- In AVC the following constraints are imposed to limit MC memory bandwidth requirements
 - An 8x8 block shares a same reference picture regardless of number of motion vectors
 - Reference block size is limited to be 576 bytes for an 8x8 block
 - For bi-directional prediction the minimum block size is limited to 8x8
- In current HM3.0 design
 - PUs down to 4x4 can have own reference index
 - Higher MC memory bandwidth will be required for HEVC
- The benefit of having ref_idx granularity down to 4x4 level should be studied

Proposed Algorithm

- For a PU of size 8x4, 4x8 or 4x4
 - Reference index is fixed to zero for list0, list1 and combined list
 - In spatial MVP derivation of merge/skip mode, an spatial MVP candidate is treated unavailable if it has non-zero reference index
 - In reference index derivation for temporal MVP in merge/skip, reference index for TMVP is fixed to zero

Test results

	Random access			Random access LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.1	0.4	0.2	0.3	0.4	0.2
Class B	0.1	0.1	0.0	0.2	0.1	0.1
Class C	0.4	0.5	0.6	0.7	0.5	0.7
Class D	0.8	0.7	0.7	0.9	0.7	0.7
Class E						
All	0.3	0.4	0.4	0.5	0.4	0.4
Enc Time[%]	95%			92%		
Dec Time[%]	100%			96%		
	Low delay			Low delay LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.2	0.2	-0.1	0.2	0.2	0.5
Class C	0.3	0.2	0.3	0.4	0.4	0.4
Class D	0.4	0.3	0.8	0.8	0.9	1.1
Class E	0.1	0.4	0.4	0.1	0.3	0.8
All	0.2	0.3	0.3	0.4	0.5	0.7
Enc Time[%]	92%			89%		
Dec Time[%]	98%			96%		

Discussions

- The benefit of having reference index granularity down to 4x4 PU level is fairly limited
- Further study is recommended to
 - Quantify the MC memory bandwidth difference for reference indices of different granularities
 - Seek more efficient algorithms to reduce the coding loss

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