

Constrained intra prediction for reducing visual artifacts caused by lossy decoder-side memory compression (JCTVC-D086/ M18836)

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Summary

- Constrained Intra Prediction (CIP)
- CIP integration in TMuC
- Simulation results
 - Random access: HE 2.1 % and LC 1.8%
 - Low delay: HE 1.7% and LC 1.4%
 - Visual quality improvement
- Recommendations
 - CIP is implemented into HM
 - Either D086 (NEC+Panasonic), D094(Panasonic), or D386(Ericsson)
 - Study the benefit of CIP in reducing visual artifacts with different decoder-side lossy processing

Constrained Intra Prediction (CIP)

Error resilience tool

- Avoid spatial noise propagations caused by encoder-decoder mismatch

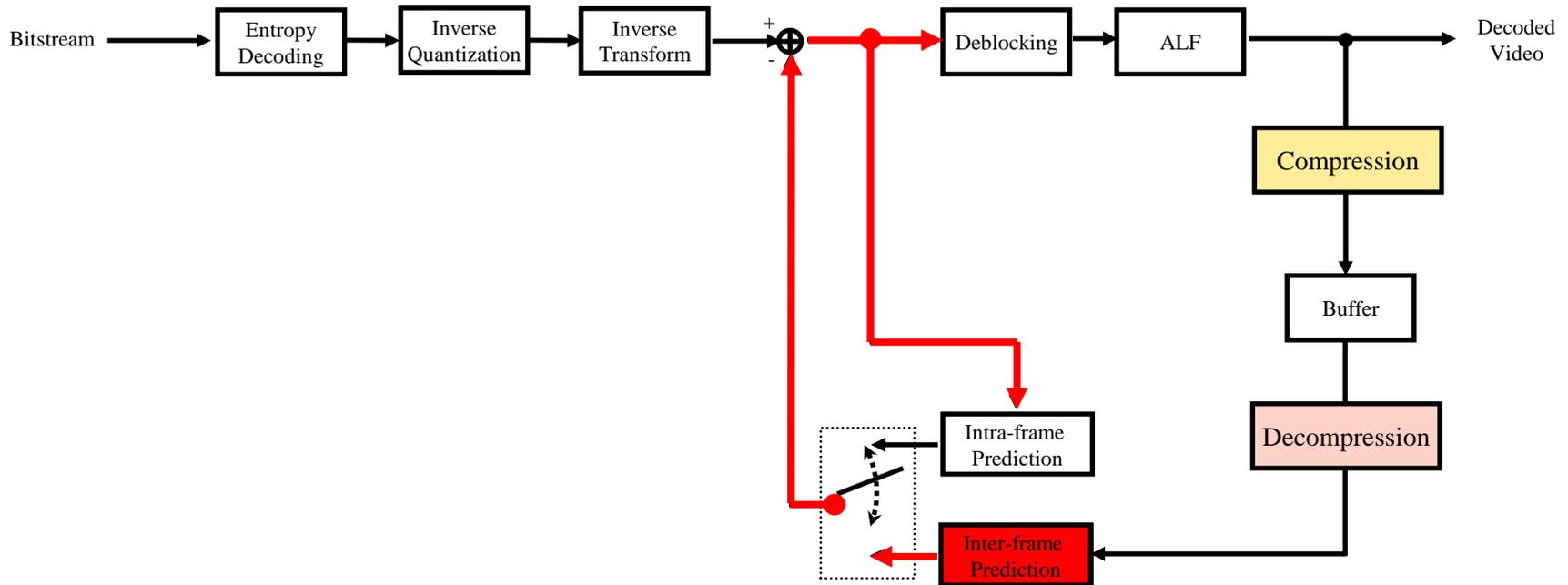
Spatial noise propagation

- Fixed-pattern noise and unacceptably noticeable

Encoder-decoder mismatch

- Packet loss in inter-coded slice transmission
- Lossy decoder-side memory compression

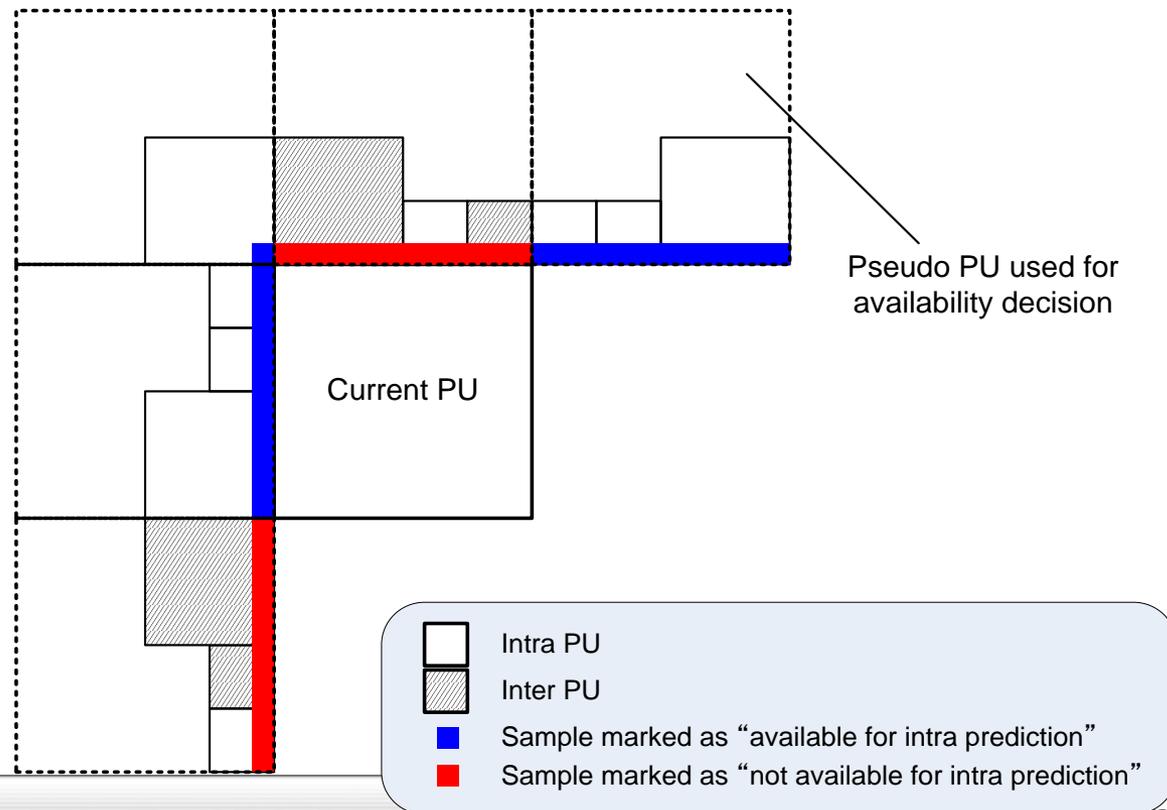
Lossy decoder-side memory compression



- CIP avoids spatial noise propagation
- Useful for allowing decoders to use their own decoder-side memory compression technique

CIP integration in HM

- Concept is identical to CIP in H.264/ MPEG-4 AVC
 - Unavailable sample value is set to 128 if any of reference samples of a neighboring PU is not available
- Panasonic and NEC independently developed software and got identical results



Simulation

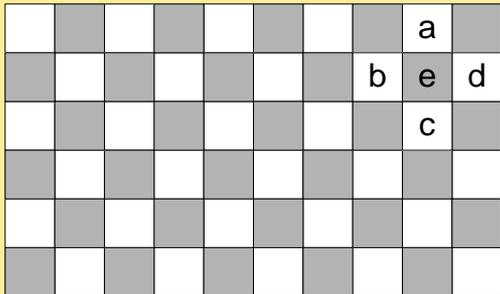
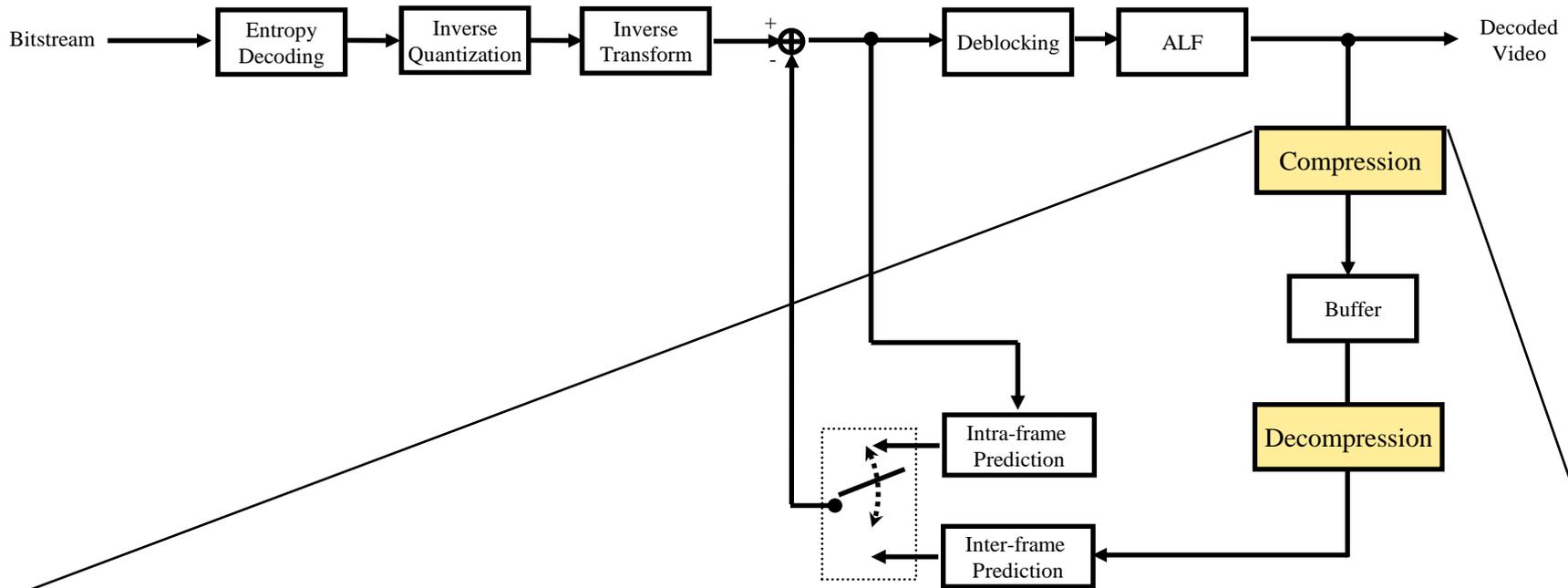
- Two tests
 - CIP performance in terms of BD-rates
 - Decoding of Anchor and CIP bitstreams
- Computing platform
 - Windows 7 64-bit on Xeon 3.33GHz and Mem. 32GB

Common test sequence results

- Marginal BD-rate increase; CIP design should be improved

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	2.0	2.5	2.5	1.6	1.7	2.1
Class B	1.7	3.4	3.1	1.5	2.6	2.7
Class C	2.7	4.5	4.4	2.3	3.4	3.4
Class D	2.0	3.5	3.7	1.7	2.2	2.5
Class E						
All	2.1	3.6	3.5	1.8	2.6	2.8
Enc Time[%]	100%			99%		
Dec Time[%]	101%			102%		
	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	1.6	3.8	3.8	1.4	2.9	3.4
Class C	2.8	5.4	5.4	2.3	3.8	4.1
Class D	1.6	3.4	3.6	1.2	2.6	2.7
Class E	0.6	1.5	1.2	0.6	2.2	1.8
All	1.7	3.7	3.6	1.4	2.9	3.1
Enc Time[%]	99%			99%		
Dec Time[%]	101%			101%		

Decoding of Anchor and CIP bitstreams by using memory compression



Pixel to be discarded

Quincunx interpolation for discarded pixel:

$$e = (a + b + c + d + 2) \gg 2$$

Decoding of Anchor and CIP bitstreams by using memory compression (Cont.)



(a) BQMall frame 552, random access, high efficiency, QP=32



(b) BQSquare frame 312, random access, high efficiency, QP=32

- CIP avoids spatial noise propagation

Findings and recommendations

● Findings through CIP implementation

- Mismatch between HM document and software in angular intra prediction for 4x4 and 8x8 blocks

```
jctvc-hm-1.0\source\Lib\TLibCommon\TComPattern.cpp(248): if (uiCuWidth<=8)  
jctvc-hm-1.0\source\Lib\TLibCommon\TComPattern.cpp(249):  bBelowLeftFlag=false;
```

- Studying tools of AVC (CIP, PCM, etc.) in HM is encouraged

● Recommendations

- CIP is implemented into HM
- Either D086 (NEC+Panasonic), D094(Panasonic), or D386(Ericsson)
- Study the benefit of CIP in reducing visual artifacts with different decoder-side lossy processing

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