

JCTVC-E069

CE6.f: LUT-based adaptive filtering on intra prediction samples

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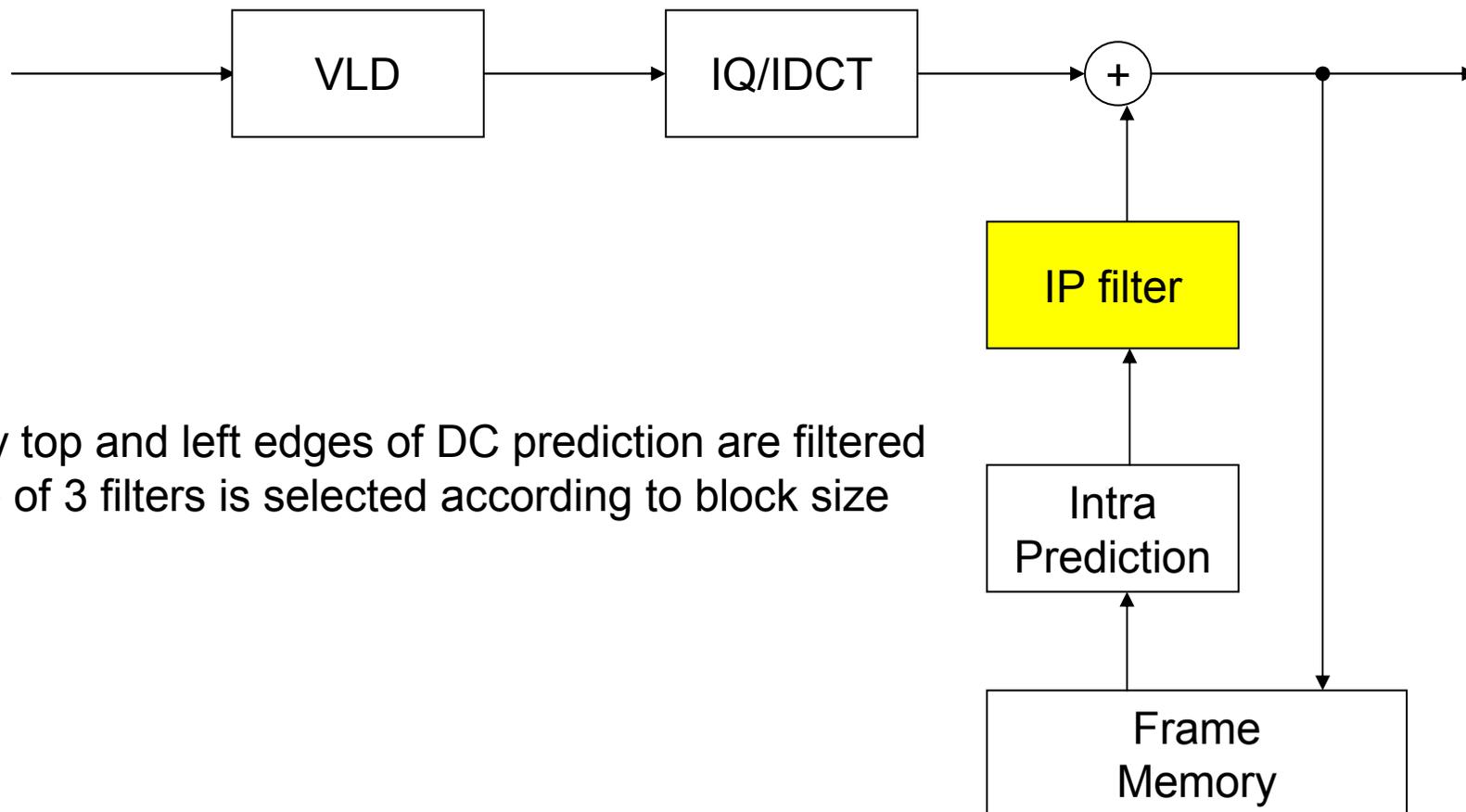
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Introduction

- In JCTVC-D109, LUT-based adaptive filtering on intra prediction samples is proposed.
 - 2 tap filter for top and left edge of DC prediction less than 32x32
 - Replace filter option “2” in MDIS with “1”
- Verification results compared to the anchor
 - BD-rate gain are 0.2%(AI/HE) and 0.4%(AI/LC)
 - Encoding times are 99%(AI/HE and AI/LC)
 - Decoding times are 99%(AI/HE) and 98%(AI/LC)
- Proposal: adopt this technology to HM-3

Intra prediction samples filtering

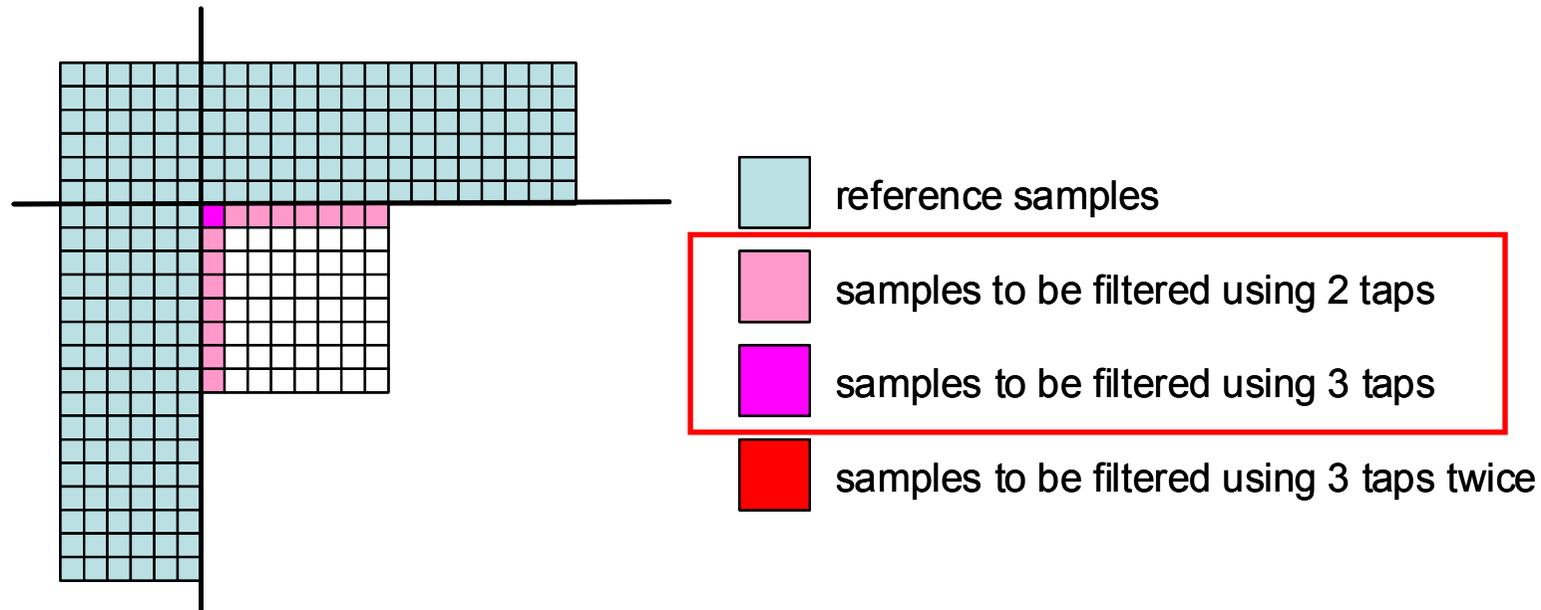
- Decoding process



- only top and left edges of DC prediction are filtered
- one of 3 filters is selected according to block size

prediction samples to be filtered

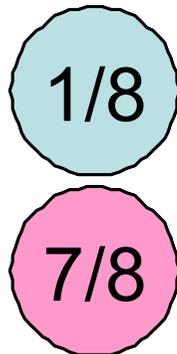
- Example: 8x8 DC prediction



Filters

- 2 tap filters except the top-left corner sample

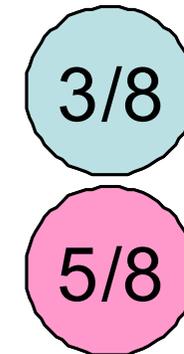
Filter #A



Filter #B



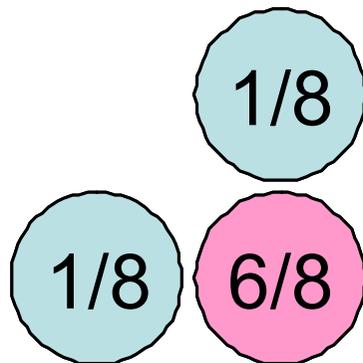
Filter #C



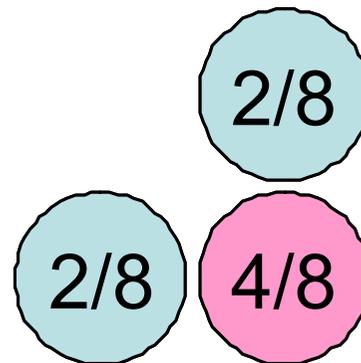
Filters

- 3 tap filters for the top-left corner sample

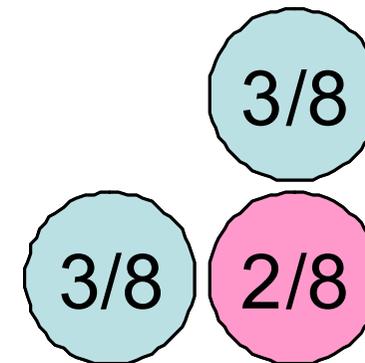
Filter #A



Filter #B

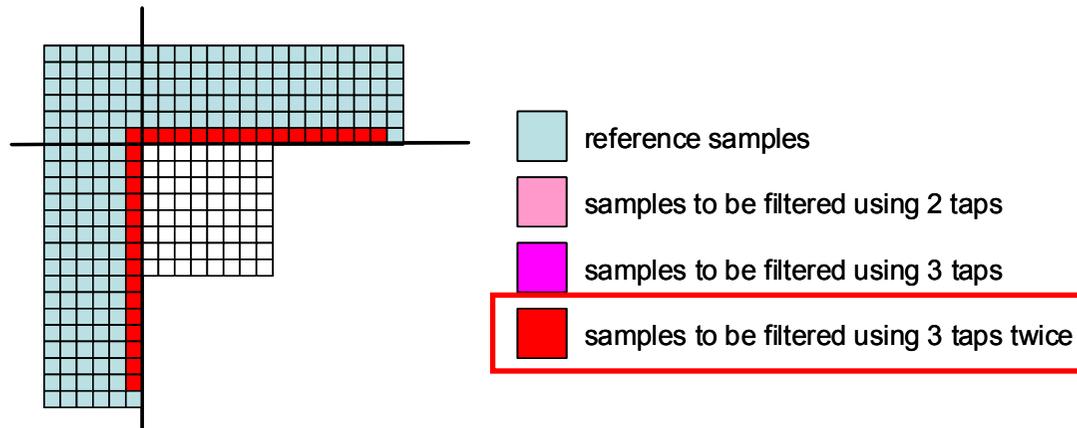


Filter #C

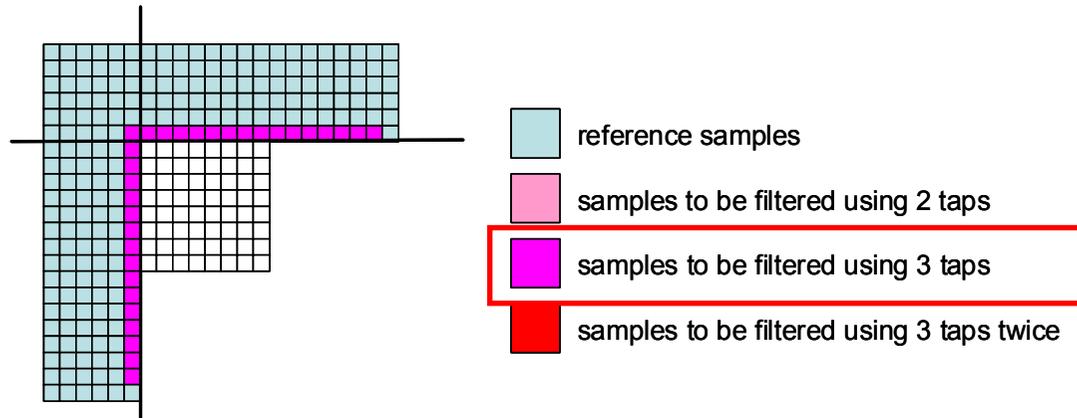


Reference samples to be filtered

- MDIS



- Proposed



Simulation Results (1)

- Anchor: HM2.0 Intra Only default conditions
- Tested: Proposed scheme implemented on HM2.0

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.1	-0.2	-0.1	-0.4	-0.2	-0.2
Class B	-0.3	-0.2	-0.2	-0.4	-0.4	-0.4
Class C	-0.3	-0.2	-0.2	-0.4	-0.3	-0.3
Class D	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
Class E	-0.2	-0.1	-0.2	-0.3	-0.3	-0.3
All	-0.2	-0.2	-0.2	-0.4	-0.3	-0.3
Enc Time[%]	99%			99%		
Dec Time[%]	99%			98%		

0.2% and 0.4% gain with complexity reduction compared to the anchor

Simulation Results (2)

- Anchor: HM2.0 Intra Only default conditions
- Tested: CE6.e Planar+DST software

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-1.0	0.1	0.5	-1.6	-2.3	-1.9
Class B	-1.3	-0.6	-0.1	-1.4	-2.4	-2.1
Class C	-1.0	-0.2	0.0	-1.3	-2.0	-2.1
Class D	-1.0	-0.4	-0.3	-1.3	-2.1	-2.2
Class E	-1.2	1.0	1.1	-1.3	-1.8	-2.0
All	-1.1	-0.1	0.2	-1.4	-2.2	-2.0
Enc Time[%]	105%			108%		
Dec Time[%]	101%			102%		

Macro settings of CE6.e software

```
#define REPLACE_DC_MODE_WITH_PLANAR 1
#define CODE_PREDERROR_DIFFERENTLY 1
#define ADD_PLANAR_MODE 1
#if REPLACE_DC_MODE_WITH_PLANAR || ADD_PLANAR_MODE
#define D326_PREDICTION 0
#define D083_PREDICTION 0
#define D235_PREDICTION 1
#endif
```

```
#if CODE_PREDERROR_DIFFERENTLY
#define DST_FOR_PLANAR 1
#endif
```

```
#if ADD_PLANAR_MODE
#define D235_MODE_SIGNALING 1 // Set to 1 for test CE6.e.3.b
#endif
```

```
#if DST_FOR_PLANAR
#define D235_TRANSFORM 1
#endif
```

```
#if ADD_PLANAR_MODE
#define NUM_INTRA_MODE 35
#define PLANAR_IDX (NUM_INTRA_MODE-1)
#endif
```

Simulation Results (3)

- Anchor: HM2.0 Intra Only default conditions
- Tested: Proposed scheme implemented on CE6.e Planar+DST software

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-1.1	0.1	0.5	-1.9	-2.4	-2.0
Class B	-1.5	-0.7	-0.3	-1.6	-2.7	-2.4
Class C	-1.3	-0.3	-0.2	-1.6	-2.3	-2.3
Class D	-1.2	-0.5	-0.4	-1.5	-2.3	-2.4
Class E	-1.3	0.9	1.0	-1.6	-2.0	-2.2
All	-1.3	-0.2	0.1	-1.6	-2.4	-2.3
Enc Time[%]	104%			108%		
Dec Time[%]	101%			101%		

Additional 0.2% gain with complexity reduction on top of Planar+DST

Conclusions

- The proposed scheme improves coding efficiency
 - 0.2% and 0.4% for Intra HE and LC respectively
 - ENC time reductions are 1% and 1% for HE and LC
 - DEC time reductions are 1% and 2% for HE and LC
- The proposed scheme improves coding efficiency even used with planar mode.
- Propose the scheme to be adopted to HM-3



Changes for the Better

Additional Results

- Clarify the performance of MDIS simplification
 - replace 2-pass filtering of MDIS to 1-pass filtering
- Clarify the performance of DC prediction filtering
- Anchor: HM2.0

Additional Results (1)

- Anchor: HM2.0 Intra Only default conditions
- Tested: Simplified MDIS

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.2	0.2	0.2	0.3	0.3	0.2
Class B	0.1	0.1	0.1	0.1	0.0	0.0
Class C	0.0	0.0	0.1	0.0	0.0	0.0
Class D	0.0	0.1	0.1	0.0	0.1	0.0
Class E	0.1	0.0	0.0	0.1	-0.1	-0.1
All	0.1	0.1	0.1	0.1	0.1	0.0
Enc Time[%]	100%			98%		
Dec Time[%]	99%			99%		

- 0.1% loss of coding efficiency
- 1-2% complexity reduction

Additional Results (2)

- Anchor: HM2.0 Intra Only default conditions
- Tested: DC prediction samples filter with default MDIS

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.3	-0.3	-0.3	-0.7	-0.4	-0.3
Class B	-0.3	-0.3	-0.2	-0.5	-0.4	-0.4
Class C	-0.3	-0.2	-0.2	-0.4	-0.3	-0.3
Class D	-0.3	-0.3	-0.3	-0.4	-0.3	-0.2
Class E	-0.2	-0.1	-0.1	-0.4	-0.2	-0.2
All	-0.3	-0.2	-0.2	-0.5	-0.3	-0.3
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

- -0.3% and 0.5% gain compared to the original HM2.0
- Additional enc/dec complexity is negligible

Observations

- Slight loss of coding efficiency but achieve a bit of complexity reduction to simplify the reference samples filter
- The DC filtering scheme improves coding efficiency
 - 0.3% and 0.5% for Intra HE and LC respectively
 - Additional enc/dec complexity is negligible

Thank you