AHG19: Method of frame-based lossless coding mode

JCTVC-H0083

Minhua Zhou

(Texas Instruments Inc., USA)

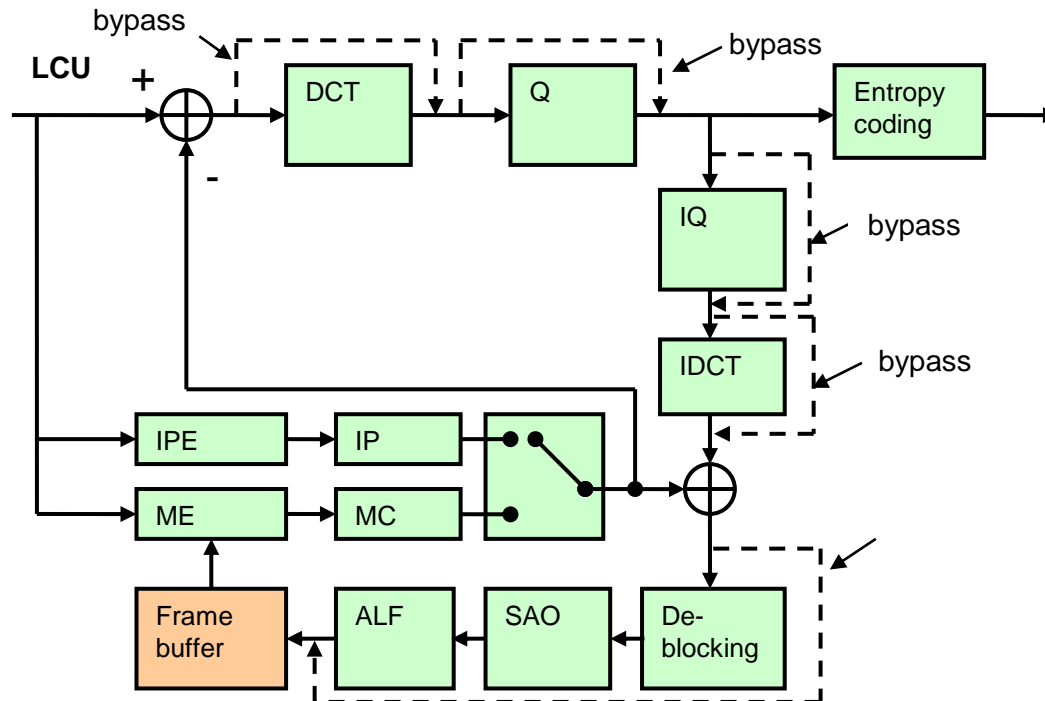TEXAS INSTRUMENTS

Motivations

1. Efficient losslesss coding mode is required for applications such as automotive vision, wireless projectors, video conferencing and long-distance education
   – AVC high-profile supports I_PCM lossless mode which offers no compression

2. Proposal
   – Insert a flag "bypass_coding_mode_enabled_flag" in PPS to enable frame-level loss by bypassing decoding process of IQ, IDCT, iLF, SAO and ALF
   – Use the sample-based angular intra prediction mode (SAP) when bypass_coding_mode_enabled_flag = 1 for improved lossless coding efficiency

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Diagram of HM5.0 lossless coding anchor mode

Anchor method: bypass transform and quantization, and disable de-blocking filter, SAO and ALF

HM5.0 block-based angular intra prediction

Vertical angular predictions

Horizontal angular predictions
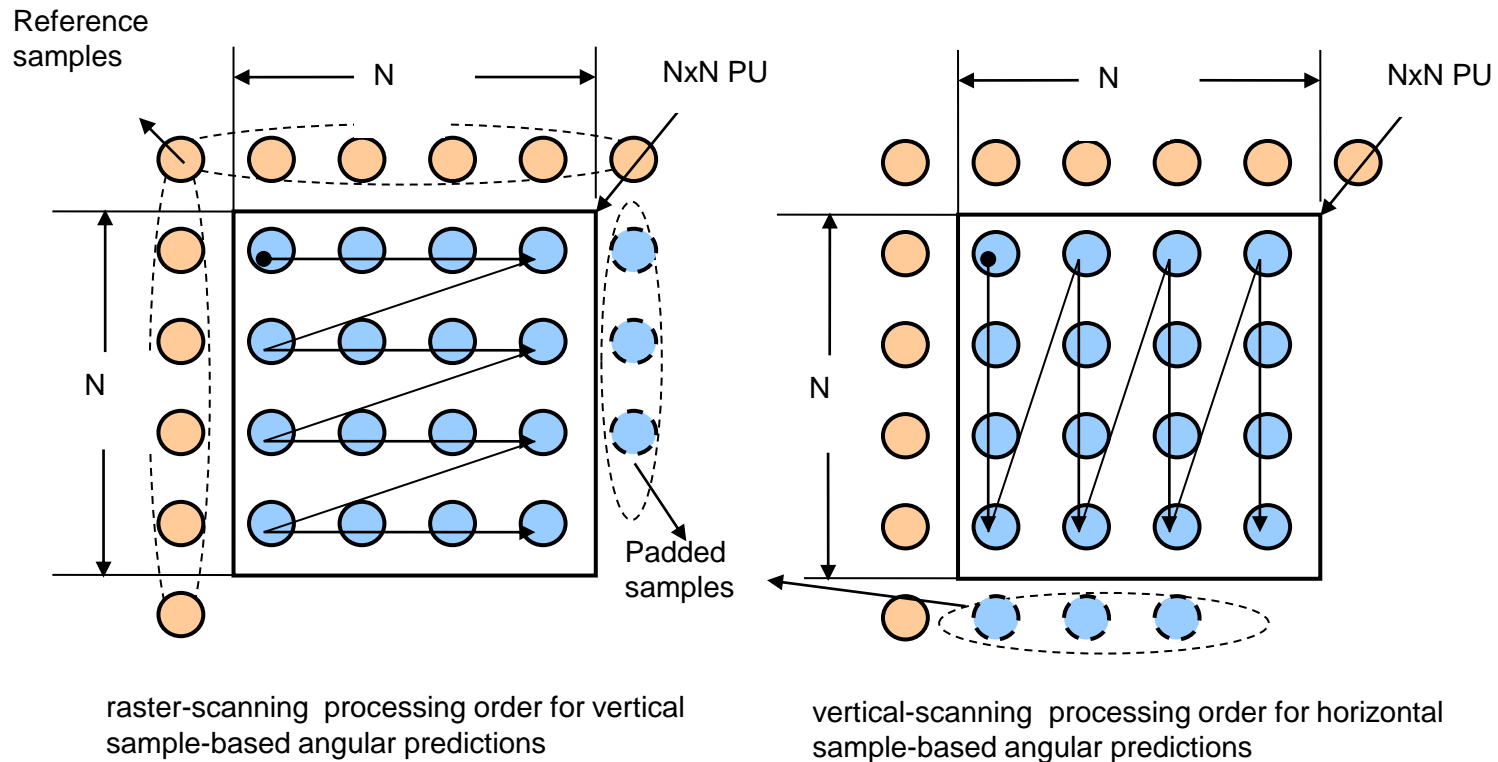
Reference samples

N

N

NxN PU
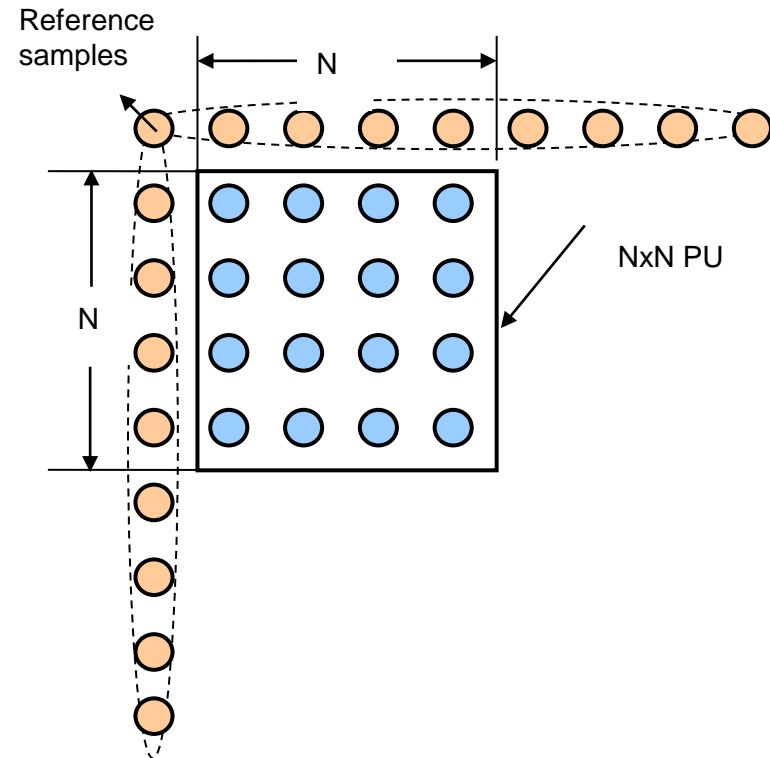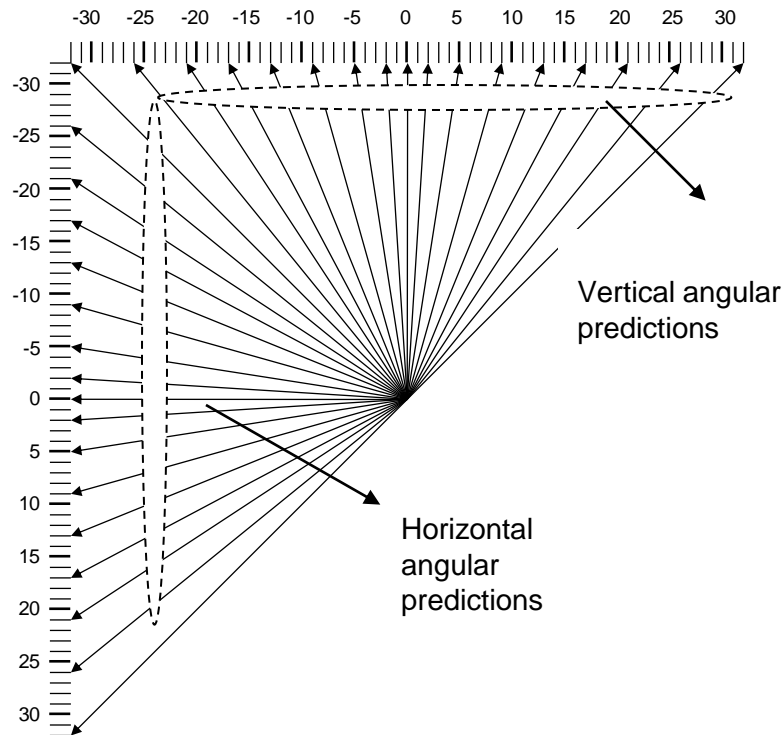
In lossless mode, not only the reference samples from neighboring PUs, but also the neighboring samples inside the current PU are available for prediction

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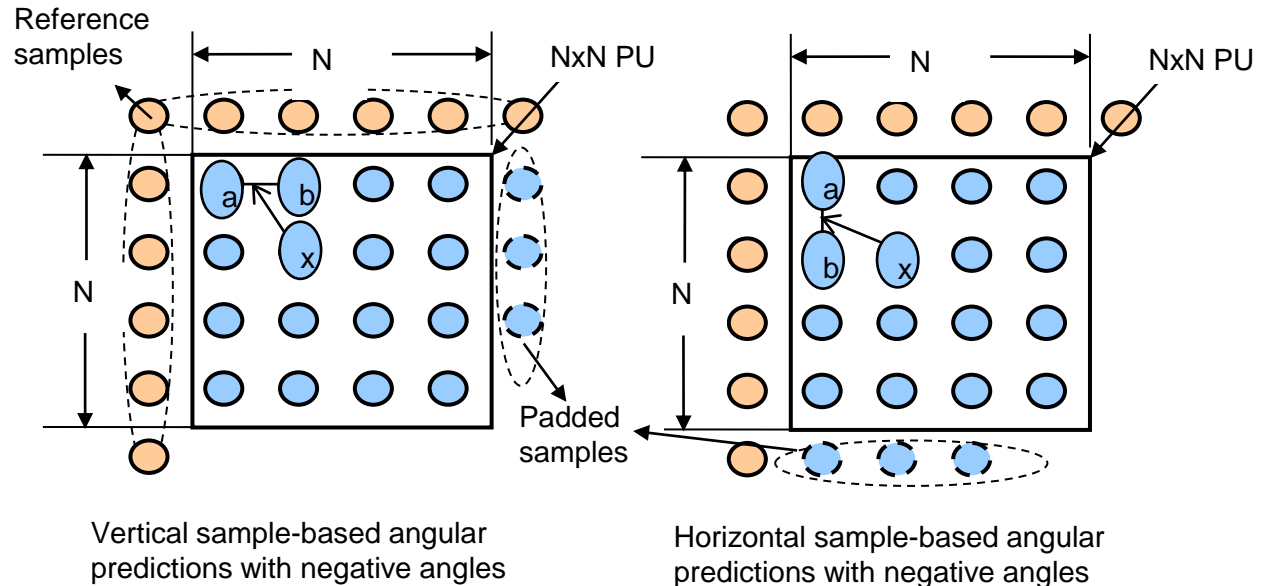
What is SAP?

1. SAP = sample-based angular intra prediction for lossless coding

2. Compared to HM5.0 block-based angular intra prediction

    - No changes in syntax and semantics

        - Same definition and signaling of prediction angles

        - Same processing for reference samples from neighboring PUs

        - All the samples inside a PU share a same prediction angle

    - Same bilinear interpolation method for generating prediction samples

    - **However, in SAP the reference samples for a sample to be predicted are from its direct neighbors and prediction has to follow pre-defined orders**

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Processing order of SAP

raster-scanning processing order for vertical sample-based angular predictions

vertical-scanning processing order for horizontal sample-based angular predictions
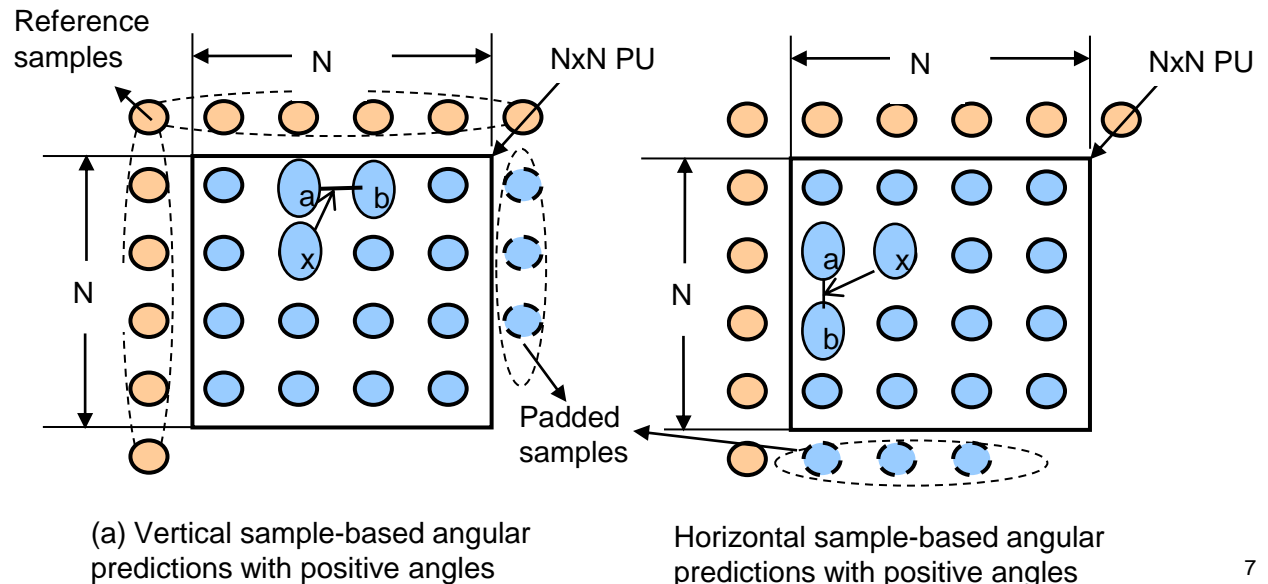
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Reference sample selections in SAP

1. For each sample to be predicted (x), two direct neighboring samples (a,b) are selected based on prediction angle

Reference samples

N

NxN PU

Vertical sample-based angular predictions with negative angles

N

NxN PU

Horizontal sample-based angular predictions with negative angles

Padded samples

2. After the reference samples are determined, the same bilinear interpolation is used for generating prediction sample

Reference samples

N

NxN PU

(a) Vertical sample-based angular predictions with positive angles

N

NxN PU

Horizontal sample-based angular predictions with positive angles

Padded samples

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Experimental Results

- In proposed algorithm the block-based angular prediction is replaced with SAP in lossless mode (relative to HM5.0 anchor lossless mode)

		AI-HE (%)	AI-LC (%)	RA-HE (%)	RA-LC (%)	LB-HE (%)	LB-LC (%)
Overall (including class F)	SAP	-8.30	-8.53	-2.85	-2.93	-2.0	-2.06
	QP = 0	13.58	13.24	16.93	16.81	18.26	18.21
Class F only	SAP	-12.23	-12.55	-7.11	-7.28	-5.72	-5.84
	QP = 0	23.48	23.09	17.01	16.83	12.16	12.14

- SAP   (HM5.0 lossless coding with SAP)
- QP = 0 (HM5.0 lossy coding with QP = 0)

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Conclusions

1. Efficient lossless coding is required for real-world applications such as automotive vision, video conferencing and long-distance education

2. The proposed SAP significantly improves the HEVC lossless coding efficiency

3. Recommend to adopt the proposed method into HM

   - Add "bypass_coding_mode_enabled_flag" in PPS for frame-level lossless coding signaling

   - Switch on the SAP when bypass_coding_mode_enabled_flag = 1

   Cross-checker: JCTVC-H0055 (NEC)

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