

Non-RCE2: Modification of DC intra prediction mode for lossless coding

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Qualcomm

Summary

- Proposes two different methods to replace the existing DC prediction mode
 - ❖ Use immediate neighbors to calculate prediction for each sample
- Rate savings for lossless coding
 - ❖ Method 1: 4.0% (w/o SC), 2.7% (w/ SC)
 - ❖ Method 2: 4.2% (w/o SC), 6.3% (w/ SC)
- Throughput and complexity
- Combination with SAP-HV (Test 4 of RCE2) and extended residual DPCM proposed in M0288

Method 1

		V		
	H	X		

$$\text{Prediction}(X) = (H + V + 1) \gg 1$$

Disable DC prediction filtering

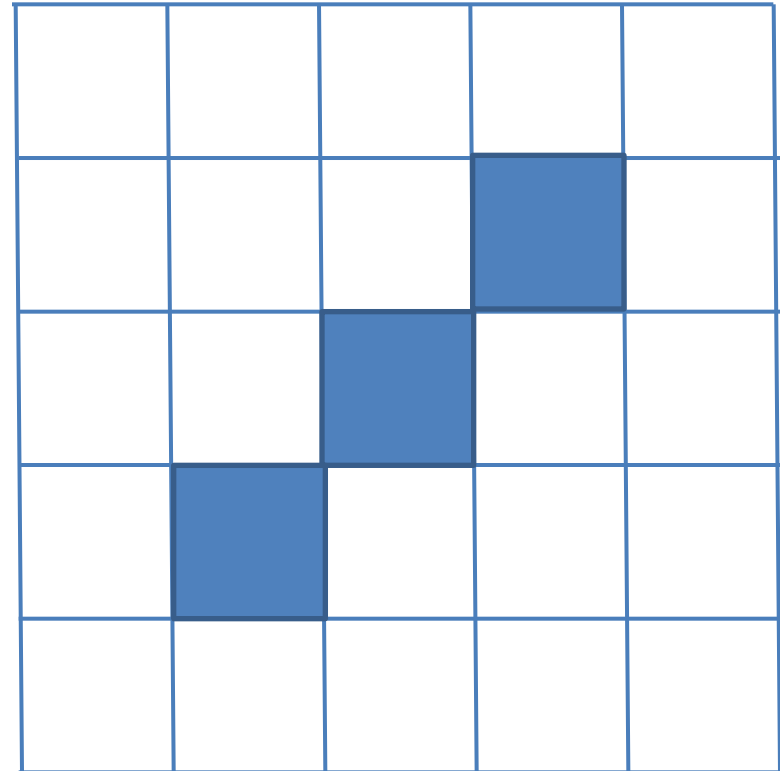
Throughput

➤ Encoder

- ❖ Fully parallel

➤ Decoder

- ❖ Dependence on the left pixel
- ❖ Pipeline by row (or column)



Complexity

➤ Increase

- ❖ 2 additions and 1 shift per sample

➤ Decrease

- ❖ Calculation of DC value not needed ($2 \times \text{tu_size} - 1$ adds)
- ❖ DC prediction filtering is not needed

Method 2

	D	V		
	H	X		

$$\text{Prediction}(X) = (H + V - D)$$

Disable DC prediction filtering

Throughput

➤ Encoder

- ❖ Fully parallel

➤ Decoder

- ❖ Each row (or column) can be processed in parallel
- ❖ Samples P_{ij} , residuals r_{ij} (row i , column j)

$$P_{i,j} = \sum_{n=0}^j r_{i,j-n} + P_{i-1,j} + P_{i,-1} - P_{i-1,-1}$$

Complexity

➤ Proposed method

- ❖ For each row ($P_{i,-1} - P_{i-1,-1}$) needs to be calculated once
- ❖ For j th sample in a row ($j = 0, 1, \dots, tu_size-1$)
 - $(j+2)$ additions are needed
- ❖ Total of $(1 + 2*tu_size + (tu_size*(tu_size-1) / 2))$ additions needed to reconstruct a row.
- ❖ For 4×4 block, 15 additions per row

➤ Original DC prediction mode

- ❖ DC calculation
- ❖ Additional complexity of DC prediction filtering
- ❖ 1 addition per sample to reconstruct

Results

	Method 1	Method 2
Class F	-3.3%	-7.0%
Class B	-5.9%	-4.3%
SC (GBR)	-1.5%	-8.3%
RangeExt	-3.8%	-1.3%
Overall (w/o SC)	-4.0%	-4.2%
Overall (w/ SC	-2.7%	-6.3%

Results in combination with SAP-HV (Test 4 of RCE 2 from M0056)

	SAP-HV (Test 4 of RCE2)	Method 2 + SAP-HV
Class F	-10.1%	-11.6%
Class B	-4.4%	-5.6%
SC (GBR)	-12.4%	-14.9%
RangeExt	-2.9%	-2.8%
Overall (w/o SC)	-6.0%	-6.9%
Overall (w/ SC)	-9.2%	-10.9%

Results in combination with extended residual DPCM (M0288)

	M0288	Method 1 + M0288	Method 2 + M0288
Class F	-11.2%	-11.8%	-12.5%
Class B	-4.9%	-7.2%	-5.8%
SC (GBR)	-13.3%	-13.5%	-15.6%
RangeExt	-3.2%	-4.5%	-2.9%
Overall (w/o SC)	-6.7%	-8.0%	-7.3%
Overall (w/ SC)	-10.0%	-10.7%	-11.5%