MEDIATEK

Non-CE8: Offset coding in SAO

Chih-Ming Fu, Yu-Wen Huang, Shawmin Lei (MediaTek)

In Suk Chong, Marta Karczewicz (Qualcomm)

Presented by Yu-Wen Huang

7th JCT-VC Meeting in Geneva

21-30 November, 2011

Overall Summary

- ## Two simple methods
  - Design a mapping function that converts offsets to indices of unary or exp-Golomb codes to better fit the offset distribution
  - Apply offset prediction from neighboring regions or bands to reduce offset magnitude

- ## Results
  - 0-0.1% luma bit rate reduction
 - 0.1-0.5% chroma bit rate reduction
  - Run time not changed

MEDIATEK

Edge Offset Categories

| Category	Condition
1	$c < 2$ neighbors
2	$c < 1$ neighbor $\&\&$ $c == 1$ neighbor
3	$c > 1$ neighbor $\&\&$ $c == 1$ neighbor
4	$c > 2$ neighbors
0	None of the above

MEDIATEK

Offset Distribution of Edge Offset (EO)

- HM-4.0 uses mapped unary codes or signed exp-Golomb codes for offsets.

  – Shortest codeword for zero input

- However, the peak of offset distribution is not always located at zero and may be shifted by ±1 or ±2.

10-bit pixels
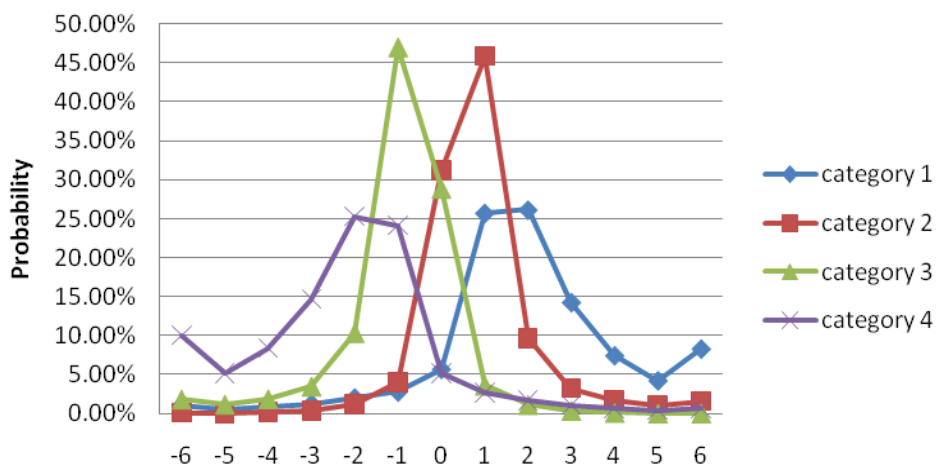
8-bit pixels
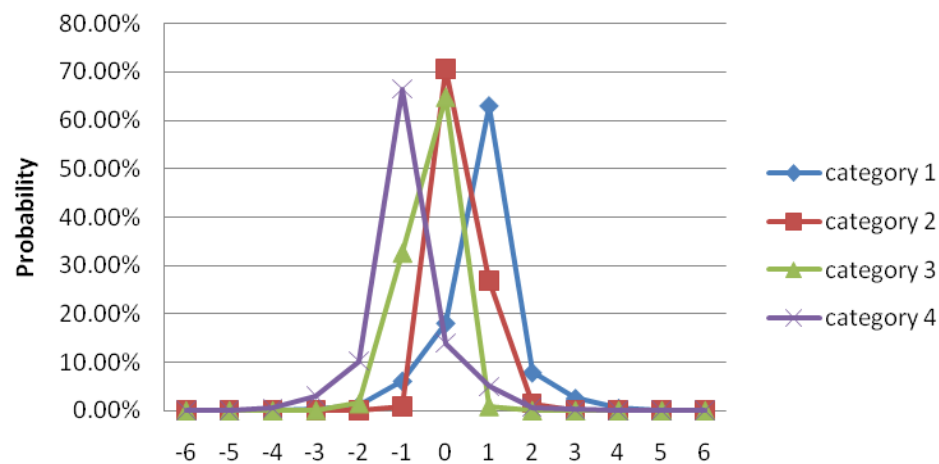
Offset Codeword Design for EO

- A mapping function to convert an **offset** to an **index**
  - If ((**offset** − **b**) < 0), **index** = − ((**offset** − **b**) << 1) − **a**
  - Else, **index** = ((**offset** − **b**) << 1) - 1 + **a**

Bit-depth	Bit-depth > 8 bit	Bit-depth = 8 bit
EO category 1	b = 2, a = 1	b = 1, a = 1
EO category 2	b = 1, a = 1	b = 1, a = 0
EO category 3	b = -1, a = 0	b = -1, a = 1
EO category 4	b = -2, a = 0	b = -1, a = 0

  - where **b** means the peak location (**index**=0), **a** equal to 1/0 means the left/right side of the peak has **index**=1
  - The **index** is used as the input of unary and exp-Golomb code table for CABAC and CAVLC, respectively
  - The smaller the **index**, the shorter the codeword

MEDIATEK

Offset Prediction

- Offset prediction for edge offset (EO)
  - Use neighboring region information
  - If the current region and the left region are in the same depth
    - Category 1 and category 2 will be predicted by the left region
    - Category 3 and category 4 will be predicted by category 2 and category 1, respectively , with the same offset magnitudes and the opposite signs.
  - Otherwise, use the proposed offset codeword design

- Offset prediction for band offset (BO)
  - The second band is predicted by the first band,
  - The 16th band is predicted by the 15th band.

MEDIATEK

Simulation Result

- Software platform: HM-4.0

- Anchor: JCTVC-F900

- Cross-check report
  - JCTVC-G818 by Samsung

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.1%
Class B	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
Class C	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.2%
Class D	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%
Class E	0.0%	-0.1%	-0.2%	0.0%	-0.1%	-0.1%
Overall	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
Enc Time[%]	99%			98%		
Dec Time[%]	100%			100%		

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0%	-0.2%	-0.5%	0.0%	0.0%	-0.2%
Class B	0.0%	-0.1%	-0.2%	-0.1%	-0.2%	-0.1%
Class C	-0.1%	-0.2%	-0.2%	0.0%	-0.2%	-0.2%
Class D	0.0%	-0.1%	-0.2%	0.0%	-0.2%	-0.2%
Class E						
Overall	0.0%	-0.1%	-0.3%	-0.1%	-0.1%	-0.2%
	0.0%	-0.1%	-0.3%	-0.1%	-0.1%	-0.2%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

	Low Delay B HE			Low Delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	-0.3%	-0.1%	0.0%	-0.1%	-0.1%
Class C	0.0%	-0.1%	-0.3%	0.0%	0.1%	-0.4%
Class D	-0.1%	-0.3%	-0.4%	0.0%	-0.4%	-0.3%
Class E	0.0%	-0.1%	0.1%	-0.1%	0.0%	-0.6%
Overall	0.0%	-0.2%	-0.2%	-0.1%	-0.1%	-0.3%
	0.0%	-0.3%	-0.2%	-0.1%	-0.1%	-0.3%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

	Low Delay P HE			Low Delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	-0.2%	-0.3%	-0.1%	-0.1%	-0.4%
Class C	-0.1%	-0.1%	0.0%	-0.1%	-0.4%	-0.2%
Class D	-0.1%	-0.4%	-0.6%	-0.1%	-0.1%	-0.6%
Class E	0.0%	-0.5%	-0.3%	-0.1%	-1.2%	-0.9%
Overall	0.0%	-0.3%	-0.3%	-0.1%	-0.4%	-0.5%
	0.0%	-0.4%	-0.3%	-0.1%	-0.4%	-0.5%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			99%		

MEDIATEK

Conclusions

- Two simple methods to improve SAO entropy coding
  - New offset codeword design to better fit the offset distribution
  - Offset prediction

- Results:
  - Luma bit rate reduced by 0-0.1%.
  - Chroma bit rate reduced by 0.1-0.5%
  - No impact on run times

MEDIATEK