JCTVC-G490 **Modified SAO edge offsets**

Kenneth Andersson

Per Wennersten

Rickard Sjöberg

Summary

- Modification of SAO edge offsets
  - Switch between constrained classification (4 edge offsets) or unconstrained classification of edges (10 edge offsets) to better fit the specific edge characteristics.
  - Prediction of edge offsets
- Performance
  - YUV BDR reduction of 0.4% (luma 0.2%, chroma 1%) versus HM4.0 for common conditions.
  - 1.1% BDR reduction for luma for low delay P low complexity
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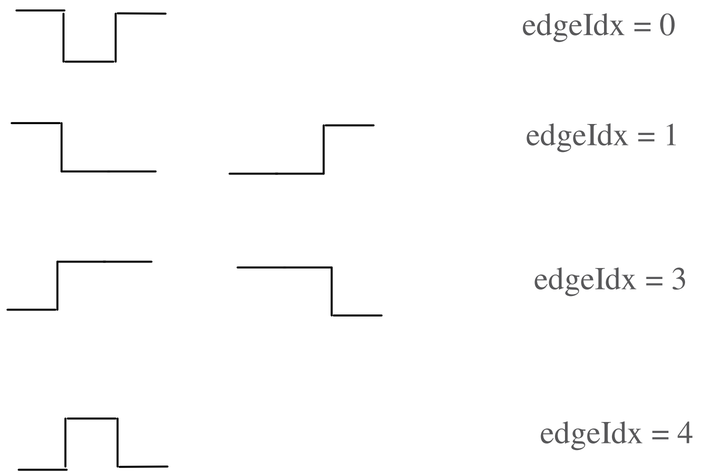
- Software available since November 8
- Thanks to Mediatek for cross-checking (JCTVC-G827)

Edge categories in HM4.0

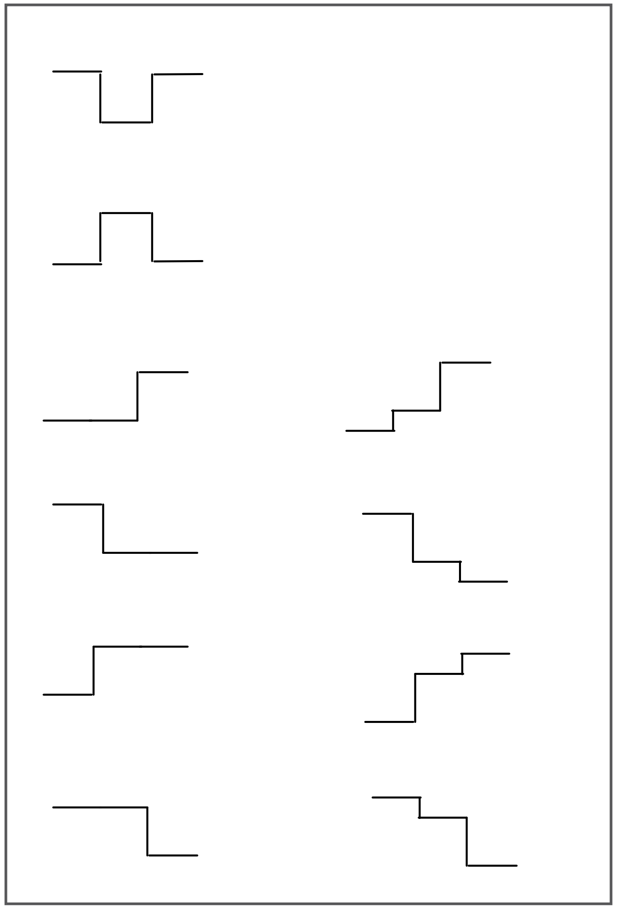
- 4 constrained offsets

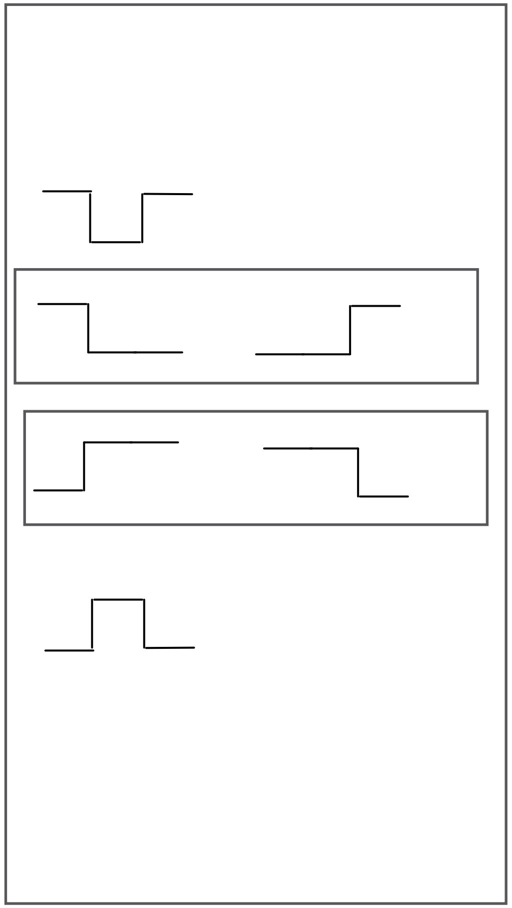


- Observation: Constraints on edgeIdx=1 and edgeIdx=3, e.g. two pixels needs to have exactly same value and no distinction between “left” and “right” edge.

Proposed edge categories

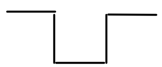
- 10 unconstrained offsets or 4 constrained offsets

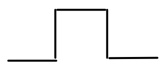




Prediction of edge offsets

- Since edge offsets for the local maxima typically are close to the negative value of the edge offset for the local minima, this proposal also uses prediction for the edge offset of the local maxima.





Algorithm complexity- EO categorization

- Consider three neighboring pixels (a, b, c) in one direction
  - HM4.0:
    - edgeIdx = 2+sign(b-a)+sign(b-c)
  - Proposed:
    - edgeIdx = 19+4*sign(b-a)+16*sign(b-c)+sign(-2b+a+c)

-> 1 sign, 3 shifts or multiplications and 3 additions more than in EO categorization in HM4.0

Syntax change due to new categorization

sao_offset_param(rx, ry, saoDepth , cIdx) {	**Descriptor**
if(sao_split_flag[cIdx][saoDepth][rx][ry]) {	
sao_offset_param(2*rx + 0, 2*ry + 0, saoDepth + 1 , cIdx)	
sao_offset_param(2*rx + 1, 2*ry + 0, saoDepth + 1 , cIdx)	
sao_offset_param(2*rx + 0, 2*ry + 1, saoDepth + 1 , cIdx)	
sao_offset_param(2*rx + 1, 2*ry + 1, saoDepth + 1 , cIdx)	
} else {	
sao_type_idx[cIdx][saoDepth][rx][ry]	ue(v) | ae(v)
if(sao_type_idx[cIdx][saoDepth][rx][ry] != 0){	
if(sao_type_idx[cIdx][saoDepth][rx][ry] <5){	
sao_eo_group_flag[cIdx][saoDepth][rx][ry]	u(1) | ae(v)
if(**sao_eo_group_flag**[cIdx][saoDepth][rx][ry])	
NumSaoClass[sao_type_idx] = 10	
else	
NumSaoClass[sao_type_idx] = 4	
}	
for(i = 0; i < NumSaoClass[sao_type_idx]; i++)	
sao_offset[cIdx][saoDepth][x0][y0][i]	se(v) | ae(v)
}	
}	
}	

Semanics change due to prediction

- An array SaoOffsetVal is specified as
- SaoOffsetVal[cIdx][saoDepth][rx][ry][0] = 0
- if(sao_type_idx[cIdx][saoDepth][rx][ry] < 5){
- SaoOffsetVal[cIdx][saoDepth][rx][ry][i+1] =
-     sao_offset[cIdx][saoDepth][rx][ry][i] << (bitDepth – Min(bitDepth, 10))
-     with i = 0, 2..NumSaoCategory – 1
- SaoOffsetVal[cIdx][saoDepth][rx][ry][i+1] =
-     (sao_offset[cIdx][saoDepth][rx][ry][1]-
  sao_offset[cIdx][saoDepth][rx][ry][0]) << (bitDepth – Min(bitDepth, 10))
-     with i = 1
- }else{
- SaoOffsetVal[cIdx][saoDepth][rx][ry][i+1] =
-     sao_offset[cIdx][saoDepth][rx][ry][i] << (bitDepth – Min(bitDepth, 10))
-     with i = 0..NumSaoCategory – 1
- }

Decoding process change

- The reconstructed picture buffer is modified as:
- recSaoPicture[xC+i,yC+j]=recPicture[xC+i,yC+j]+ saoValueArray[edgeTable[saoEoGroupFlag][edgeIdx]] with i=0..nS-1 and j=0..nS-1, edgeTable[2][39]=
- {1, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2}
- {1, 0, 0, 0, 3, 0, 7, 0, 9, 0, 0, 0, 0, 0, 0, 0, 5, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 8, 0, 10, 0, 6, 0, 0, 0, 2}}

Overall BDR performance

	Y	U	V	6YUV/8
Common conditions	-0,2%	-1,0%	-1,1%	-0,37%
Common conditions+P	-0,3%	-1,0%	-1,1%	-0,46%
HE + P	-0,1%	-0,7%	-0,7%	-0,21%
LC + P	-0,5%	-1,3%	-1,5%	-0,71%
All Intra	0,0%	-0,7%	-0,8%	-0,20%
RA	-0,1%	-1,0%	-1,1%	-0,37%
LD-B	-0,3%	-1,2%	-1,4%	-0,55%
LD-P	-0,6%	-1,0%	-1,0%	-0,71%

Overall encoding and decoding time

Enctime (common cond):	NA (100%)
Enctime including P	NA (100%)
Dectime (common cond):	101,8% (102,6%)
Dectime including P	102,1% (102,9%)

NA - encoding time on LSF cluster

(x%) - encoding time from JCTVC-G827

x% - decoding time on single machine

(x%) - decoding time from JCTVC-G827

Conclusion

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