



Sample Adaptive Offset for Chroma

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Overall Summary

- Apply the same SAO for luma on chroma as well
- Three components are independent.
- Results:
 - Encoding and decoding times were similar to those of the anchor.
 - Luma BD-rate degradations were less than 0.1% in average.
 - Chroma BD-rates showed significant gains as follows:

| | HE-AI | HE-RA | HE-LD | LC-AI | LC-RA | LC-LD |
|----|-------|-------|-------|-------|-------|-------|
| Cb | -2.0% | -3.3% | -4.6% | -1.8% | -2.7% | -6.3% |
| Cr | -2.9% | -3.9% | -5.9% | -2.4% | -2.8% | -7.6% |

Simulation Result

- Anchor: JCTVC-E700
- Software platform:
HM-3.0
- Cross-check report:
JCTVC-F364
 - Thank In Suk Chong
(Qualcomm)

| | All intra HE | | | All intra LC | | |
|----------------|--------------|-------------|-------------|--------------|-------------|-------------|
| | Y | U | V | Y | U | V |
| Class A | 0.1 | -3.2 | -5.0 | 0.1 | -2.2 | -3.2 |
| Class B | 0.2 | -1.7 | -3.2 | 0.1 | -1.5 | -2.2 |
| Class C | 0.2 | -1.8 | -2.5 | 0.2 | -1.9 | -2.8 |
| Class D | 0.1 | -0.8 | -1.2 | 0.1 | -1.3 | -1.9 |
| Class E | 0.2 | -3.0 | -2.1 | 0.1 | -2.5 | -2.3 |
| Overall | 0.2 | -2.0 | -2.9 | 0.1 | -1.8 | -2.4 |
| Enc Time[%] | 102% | | | 99% | | |
| Dec Time[%] | 98% | | | 96% | | |

| | Random access HE | | | Random access LC | | |
|----------------|------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V |
| Class A | 0.0 | -5.6 | -6.3 | 0.0 | -4.8 | -4.8 |
| Class B | 0.0 | -3.2 | -3.7 | 0.1 | -3.1 | -2.5 |
| Class C | 0.1 | -2.6 | -3.3 | 0.1 | -2.1 | -3.2 |
| Class D | 0.1 | -1.8 | -2.3 | 0.1 | -0.8 | -1.0 |
| Class E | | | | | | |
| Overall | 0.0 | -3.3 | -3.9 | 0.1 | -2.7 | -2.8 |
| Enc Time[%] | 98% | | | 102% | | |
| Dec Time[%] | 98% | | | 101% | | |

| | Low delay (B) HE | | | Low delay (B) LC | | |
|----------------|------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V |
| Class A | | | | | | |
| Class B | -0.1 | -5.1 | -6.3 | 0.0 | -6.5 | -7.4 |
| Class C | 0.0 | -4.8 | -6.4 | 0.1 | -5.6 | -7.7 |
| Class D | 0.0 | -2.9 | -3.5 | 0.1 | -3.4 | -4.4 |
| Class E | 0.1 | -5.7 | -7.8 | 0.3 | -11.0 | -11.7 |
| Overall | 0.0 | -4.6 | -5.9 | 0.1 | -6.3 | -7.6 |
| Enc Time[%] | 101% | | | 100% | | |
| Dec Time[%] | 100% | | | 102% | | |

Conclusions

- SAO is also effective on chroma
- Results:
 - Encoding and decoding times were similar to those of the anchor.
 - Luma BD-rate degradations were less than 0.1% in average.
 - Chroma BD-rates showed significant gains as follows:

| | HE-AI | HE-RA | HE-LD | LC-AI | LC-RA | LC-LD |
|----|-------|-------|-------|-------|-------|-------|
| Cb | -2.0% | -3.3% | -4.6% | -1.8% | -2.7% | -6.3% |
| Cr | -2.9% | -3.9% | -5.9% | -2.4% | -2.8% | -7.6% |

Proposed Method

- If the SAO for luma is turned on for current picture, the same SAO algorithm can be applied on Cb and Cr.
- Use one flag for each component to indicate the on/off control of SAO.
- Each component is independent and has its own partitions and offsets.
- The chroma syntax structure is the same as the luma syntax structure in HM-3.0

| |
|---------------------------|
| sao_param() { |
| sao_flag |
| if(sao_flag) { |
| SAO is turned on for luma |
| sao_flag_cb |
| if(sao_flag_cb) { |
| SAO is turned on for Cb |
| } |
| sao_flag_cr |
| if(sao_flag_cr) { |
| SAO is turned on for Cr |
| } |
| } |
| } |