Constrained Directional Enhancement Filter

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Directional Deringing Filter

• Operates on 8x8 blocks
  - Estimates direction (luma only)
  - Conditional replacement filter
    • First along directions
    • Second across directions

• Global frame-level strength (quality-dependent)

• Superblock (64x64) strength adjustment
  - Four possible values (including “off”)
CDEF Proposal

• Merging the directional deringing filter and the constrained lowpass filter into a single filter
• CLPF replaces second ("orthogonal") conditional replacement filter in dering
• Resulting complexity is similar to dering
• Results exceed both dering and clpf alone, as well as the original dering+clpf combination
• Signalling 64x64 blocks, 1 to 8 possible strengths
Results

• AreWeCompressedYet, objective-1-fast
• Real-time and non-real-time configurations
  - Better results for real-time (no B frames)
  - Better results as complexity goes down

<table>
<thead>
<tr>
<th>Bitrate (bpp)</th>
<th>PSNR</th>
<th>CIEDE 2000</th>
<th>PSNR-HVS</th>
<th>SSIM</th>
<th>MS-SSIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-latency</td>
<td>-2.07%</td>
<td>-2.02%</td>
<td>-0.74%</td>
<td>-1.63%</td>
<td>-0.90%</td>
</tr>
<tr>
<td>Low-latency</td>
<td>-3.92%</td>
<td>-3.67%</td>
<td>-2.44%</td>
<td>-3.42%</td>
<td>-2.58%</td>
</tr>
<tr>
<td>Low-latency, cpu-used=4</td>
<td>-7.58%</td>
<td>-7.40%</td>
<td>-5.41%</td>
<td>-7.87%</td>
<td>-6.09%</td>
</tr>
</tbody>
</table>
Complexity

• Encoder complexity <1%
• Decoder complexity ~12%
  - Still more optimizations to make
• Hardware line buffer: 6 lines
• Two search strategies
  - Whole-frame optimization
  - Heuristic-driven 64x64 decisions
TODO

• Perceptual distortion metric
• Entropy coding strengths
• Optimize interaction with other tools
CDEF Disabled
CDEF Enabled