draft-valin-netvc-deringing-00

Jean-Marc Valin

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Introduction

- Ringing: oscillations near edges due to quantization
- Goals of deringing filter
  - Remove ringing artefacts
  - Preserve edges and texture
  - Have reasonable complexity
  - Be easy to vectorize (SIMD)
Deringing Filter Steps (Decoder)

• For each 32x32 superblock
  – If superblock is skipped or flag=0, stop here
  – For each 8x8 block
    • If block is skipped, go to next block
    • Estimate direction on luma
    • Compute thresholds
    • Compute conditional replacement filter along direction
    • Compute conditional replacement filter across direction
Direction Estimation

- Runs on decoded image, so not signaled
- Find direction that minimize difference between input and directional pattern

Example:

```
0 0 1 1 2 2 3 3
1 1 2 2 3 3 4 4
2 2 3 3 4 4 5 5
3 3 4 4 5 5 6 6
4 4 5 5 6 6 7 7
5 5 6 6 7 7 8 8
6 6 7 7 8 8 9 9
7 7 8 8 9 9 10 10
```
Thresholds

- Estimate the expected amplitude of the ringing in a particular block
- Depends on
  - Quantizer used (bitrate)
  - Variance in the 32x32 superblock
  - Variance in the 8x8 block
Conditional Replacement Filter

- Want to smooth out ringing, but not edges
- Use the value of the center pixel in place of dissimilar pixels

Threshold = 5

![Conditional Replacement Filter Diagram]

- Average = 29
- Average = 24
Conditional Replacement Filter

- Can add position-dependent weights
- Unlike bilateral filter, normalization is constant
  - Easy to vectorize
  - Can choose power of two
- Practical implementation
  - Compute based on difference with center pixel
  - Accumulate difference or zero
  - Can filter one row of pixels at a time (SIMD)
Conditional Replacement Filter

Original

Noisy

Low-pass Filter

Conditional Replacement Filter
Filtering Along Direction

- Filter with 7 taps along detected direction
- Less likely to encounter edges
Filtering Across Direction

- Additional 5-tap filter (for smooth backgrounds)
- More conservative threshold
Example (without deringing)
Example (with deringing)
Objective Results

- AWCY BD-rate over 0.25 bpp to 1.2 bpp
  - 6.5% (PSNR), 4.7% PSNR-HVS
Questions?