

draft-valin-netvc-deringing-00

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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:

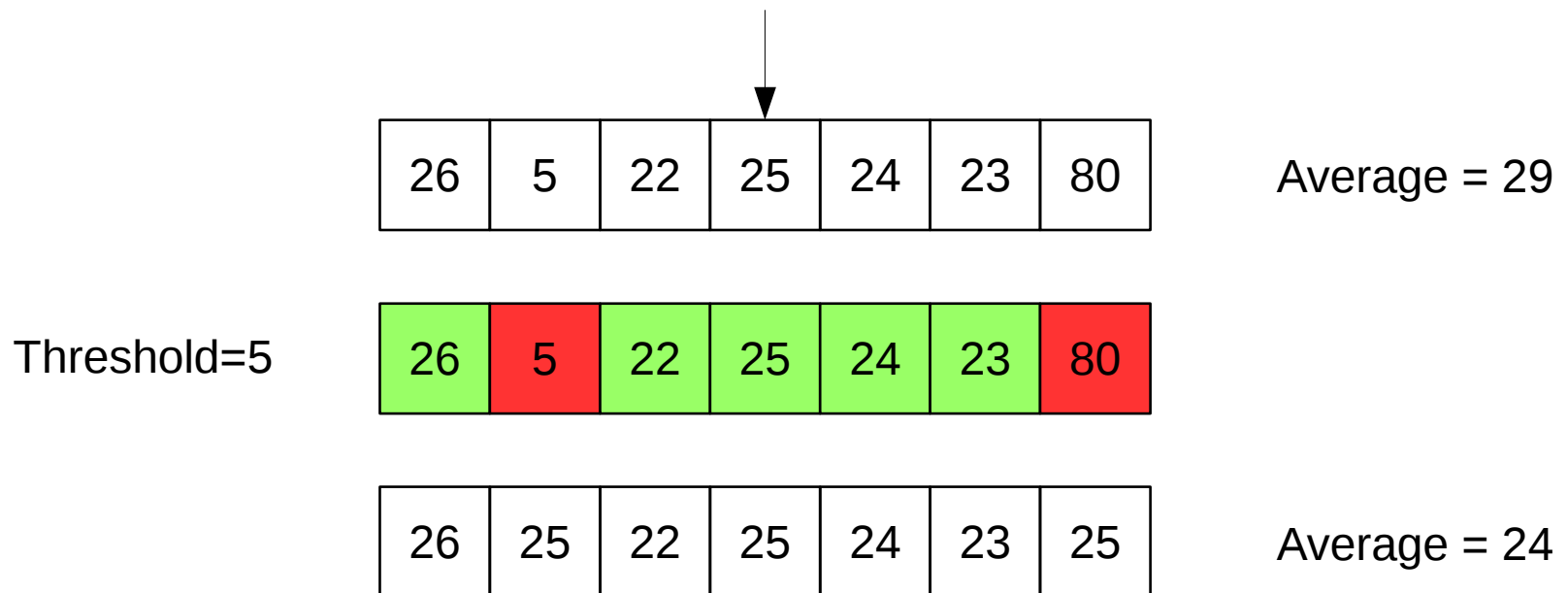
0	0	1	1	2	2	3	3
1	1	2	2	3	3	4	4
2	2	3	3	4	4	5	5
3	3	4	4	5	5	6	6
4	4	5	5	6	6	7	7
5	5	6	6	7	7	8	8
6	6	7	7	8	8	9	9
7	7	8	8	9	9	10	10

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

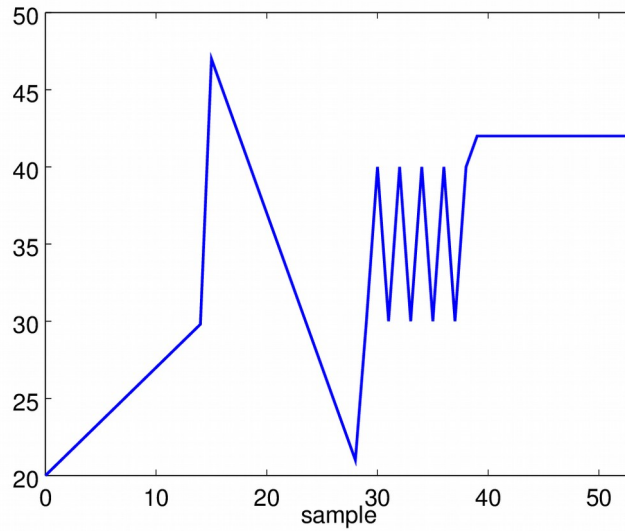


Conditional Replacement Filter

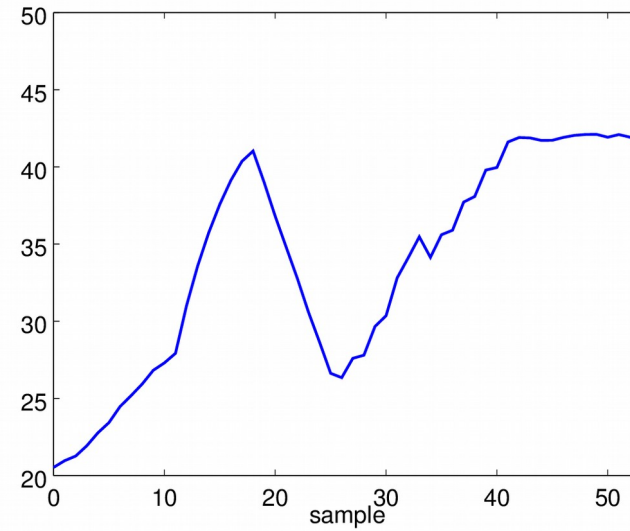
- Can add position-dependent weights
- Unlike bilateral filter, normalization is constant
 - Easy to vectorize
 - Can choose power of two
- Practical implementation
 - Compute based on difference with center pixel
 - Accumulate difference or zero
 - Can filter one row of pixels at a time (SIMD)

Conditional Replacement Filter

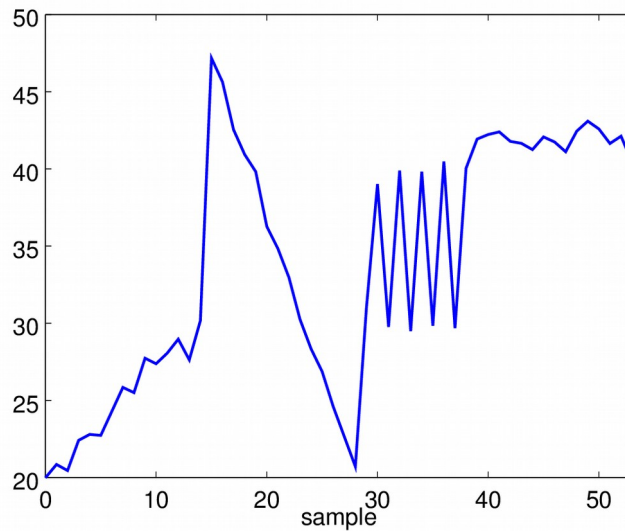
Original



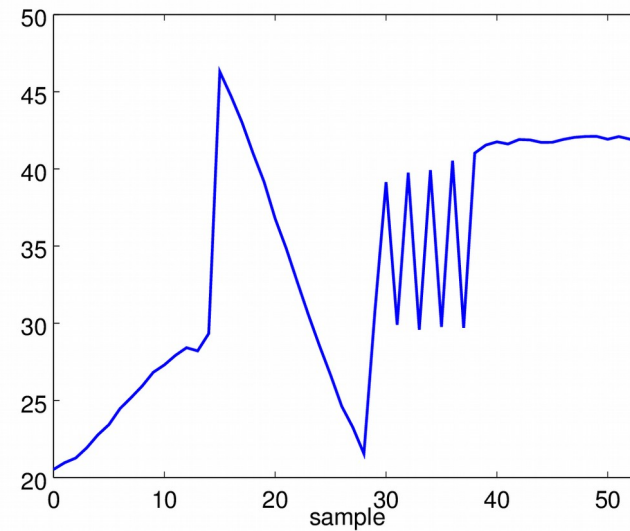
Low-pass
Filter



Noisy

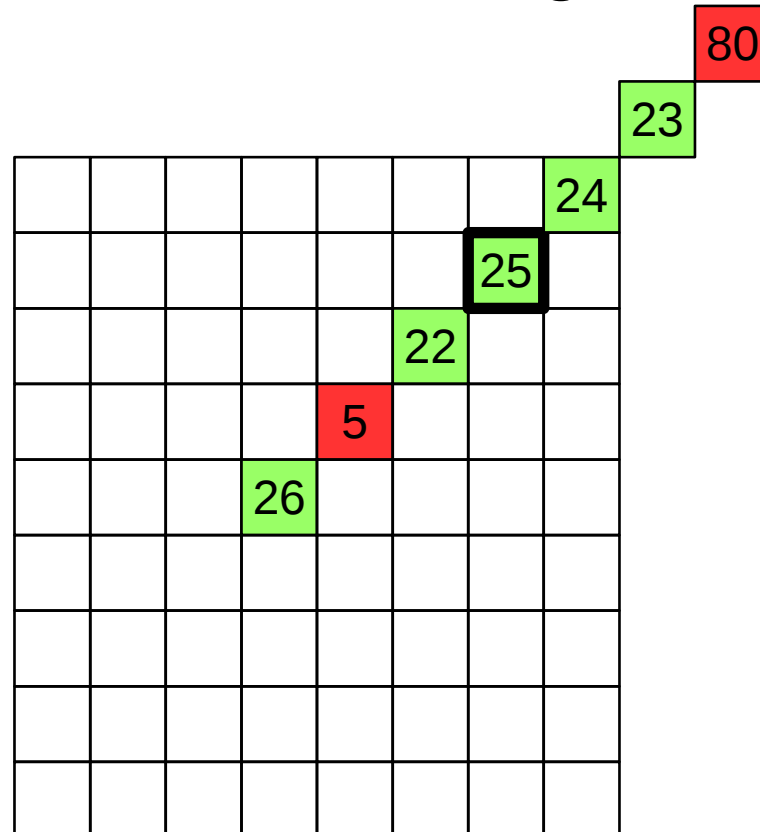


Conditional
Replacement
Filter



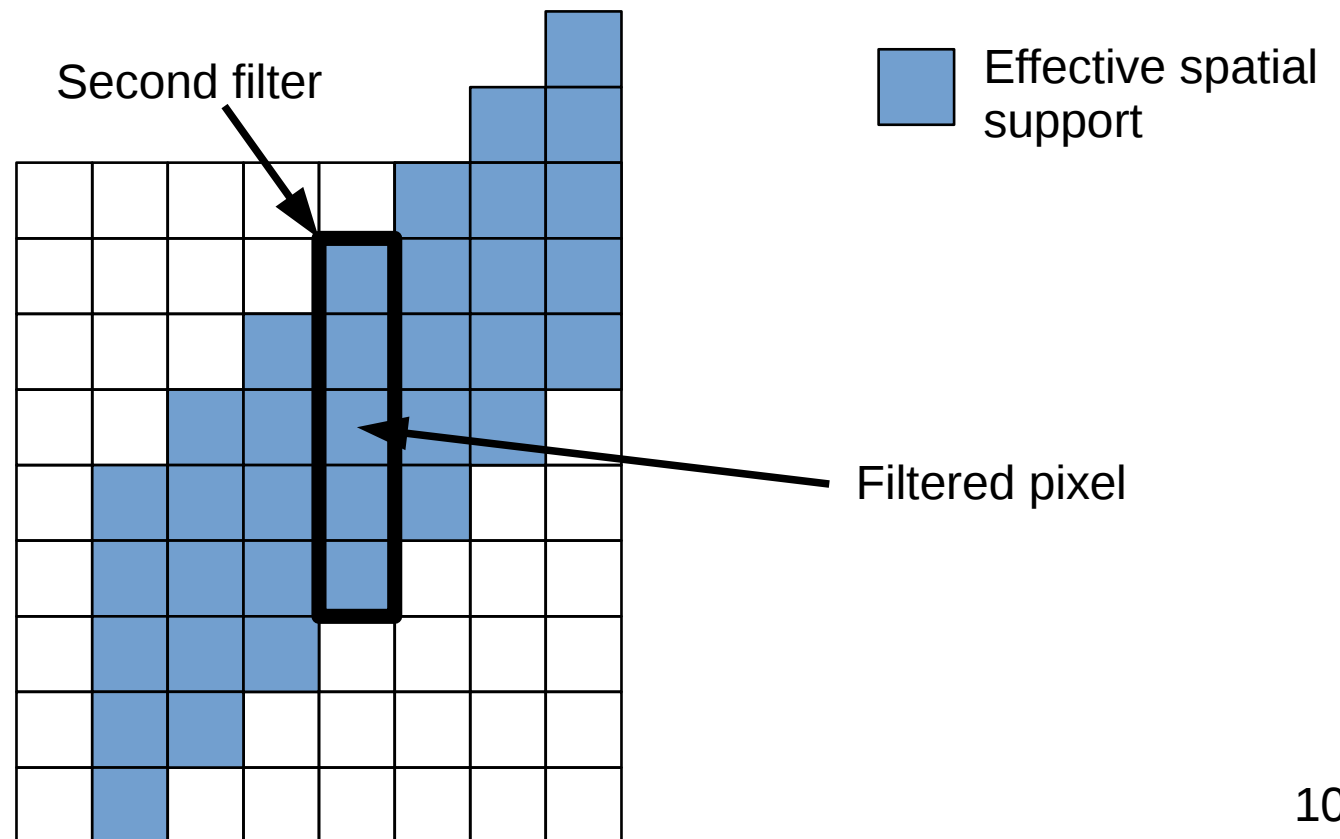
Filtering Along Direction

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

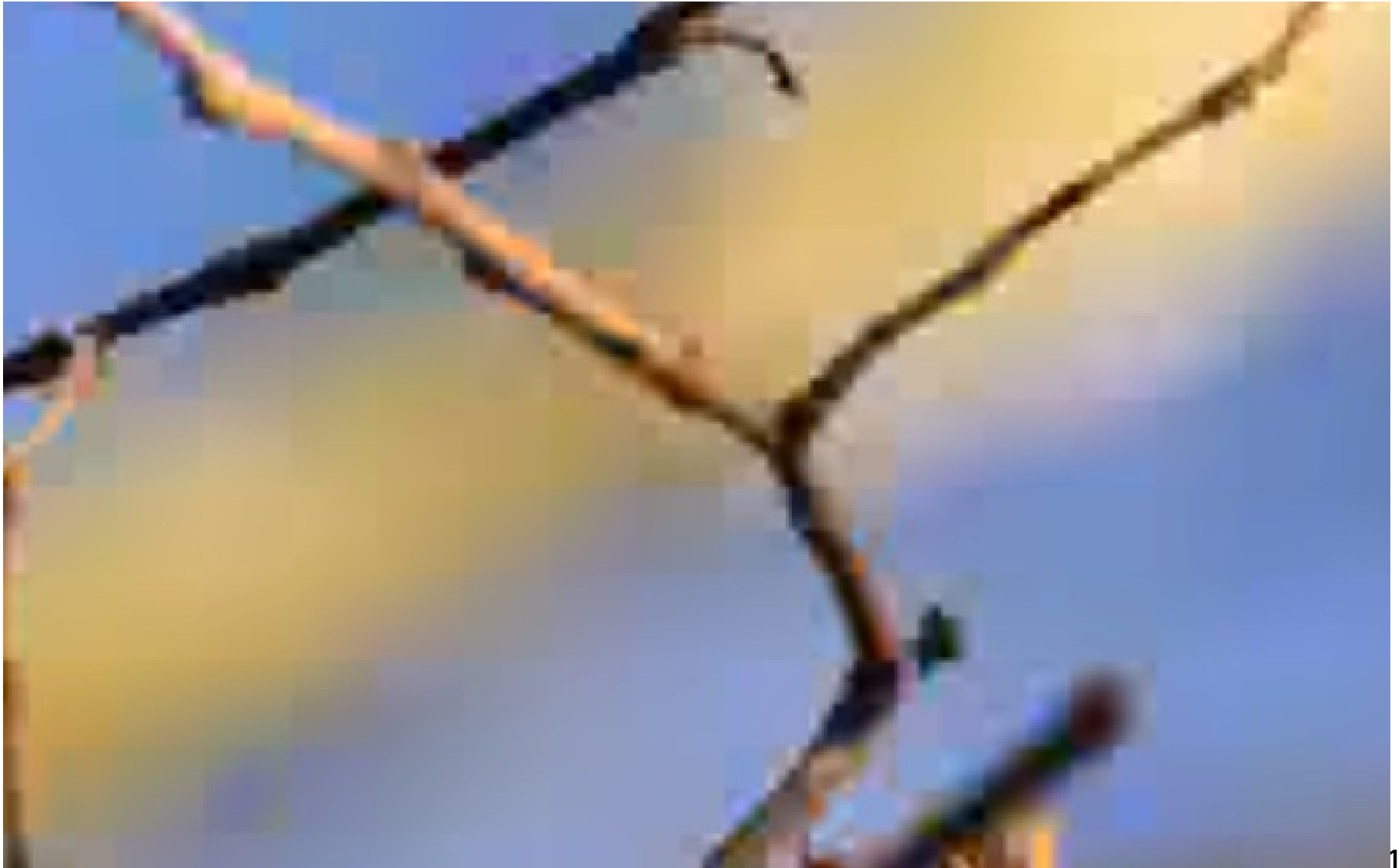


Filtering Across Direction

- Additional 5-tap filter (for smooth backgrounds)
- More conservative threshold



Example (without deringing)

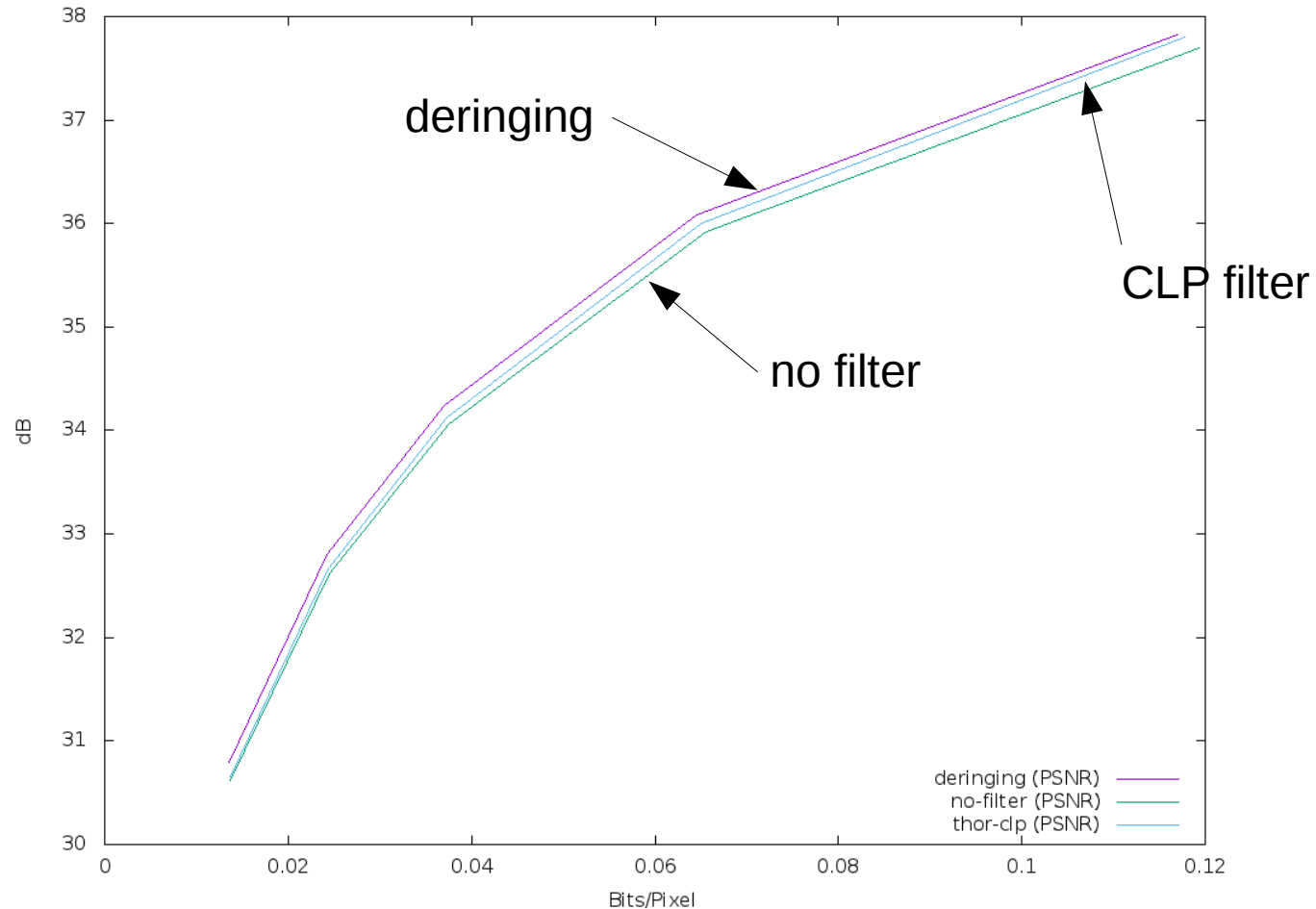


Example (with deringing)



Objective Results

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



Questions?