AV1 Status update

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What is AV1

- Interoperable and open
- Optimized for the Internet
- Scalable to any modern device at any bandwidth
- Designed with a low computational footprint and optimized for hardware
- Capable of consistent, highest-quality, real-time video delivery
- Flexible for both commercial and non-commercial content, including user-generated content

What is AV1 (decoded)

- Royalty free
- Open development
- Lots of companies who deal with video on the internet involved
  - Will see adaption
- Lots of members own patents we can use to make the codec better
- Avoiding alien IP means we have to work around patents and possibly discover better ways than the old tried and true techniques

Reference encoder

- Reference encoder based on libvpx
  - Without VP8 support
  - With some bugfixes
- Every tool added initially as an experiment after passing review
- After passing IP review it gets enabled by default and becomes part of the codec *
- After codec bitstream gets frozen experiments that didn't make it get removed * **

* - Hasn't happened yet

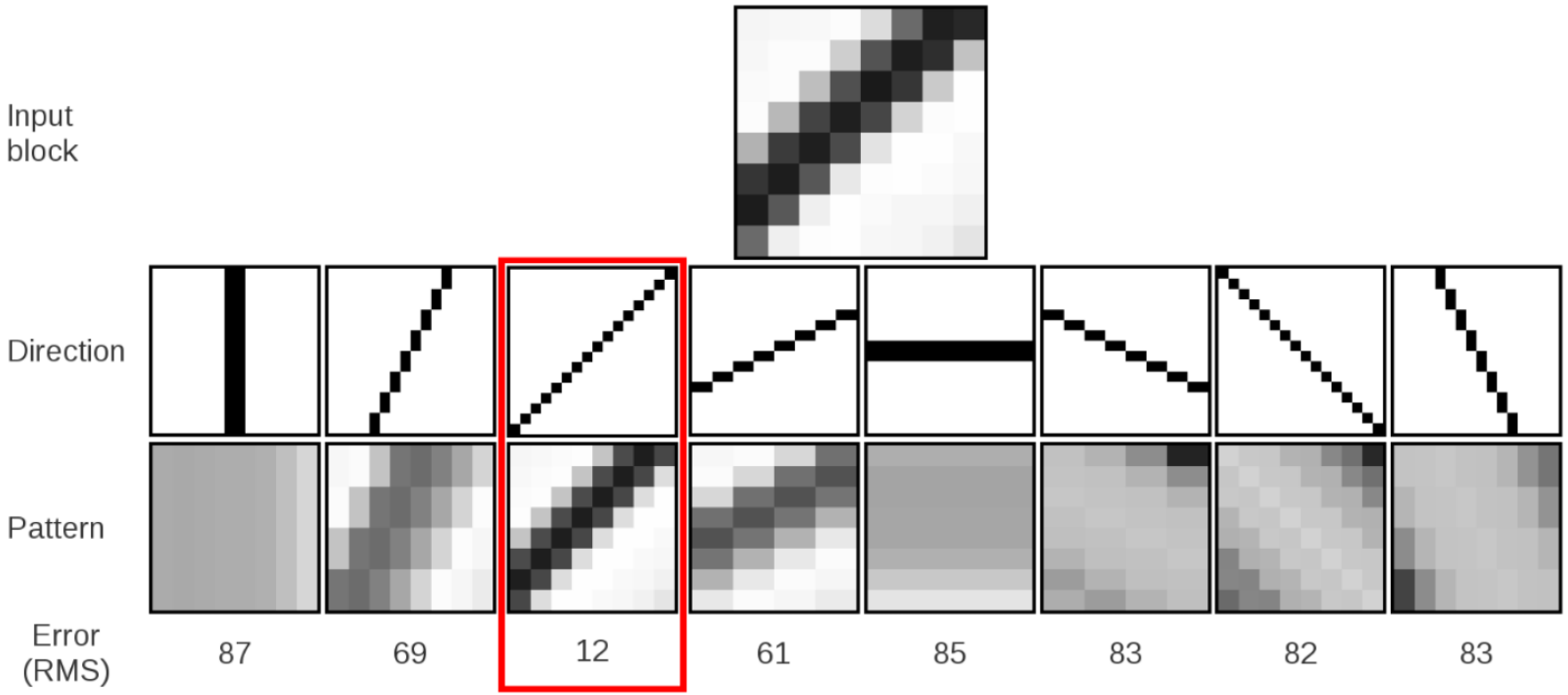
** - Won't happen until the end of the year

A codec is only as good as its coding tools

Currently there are over 50 experiments:

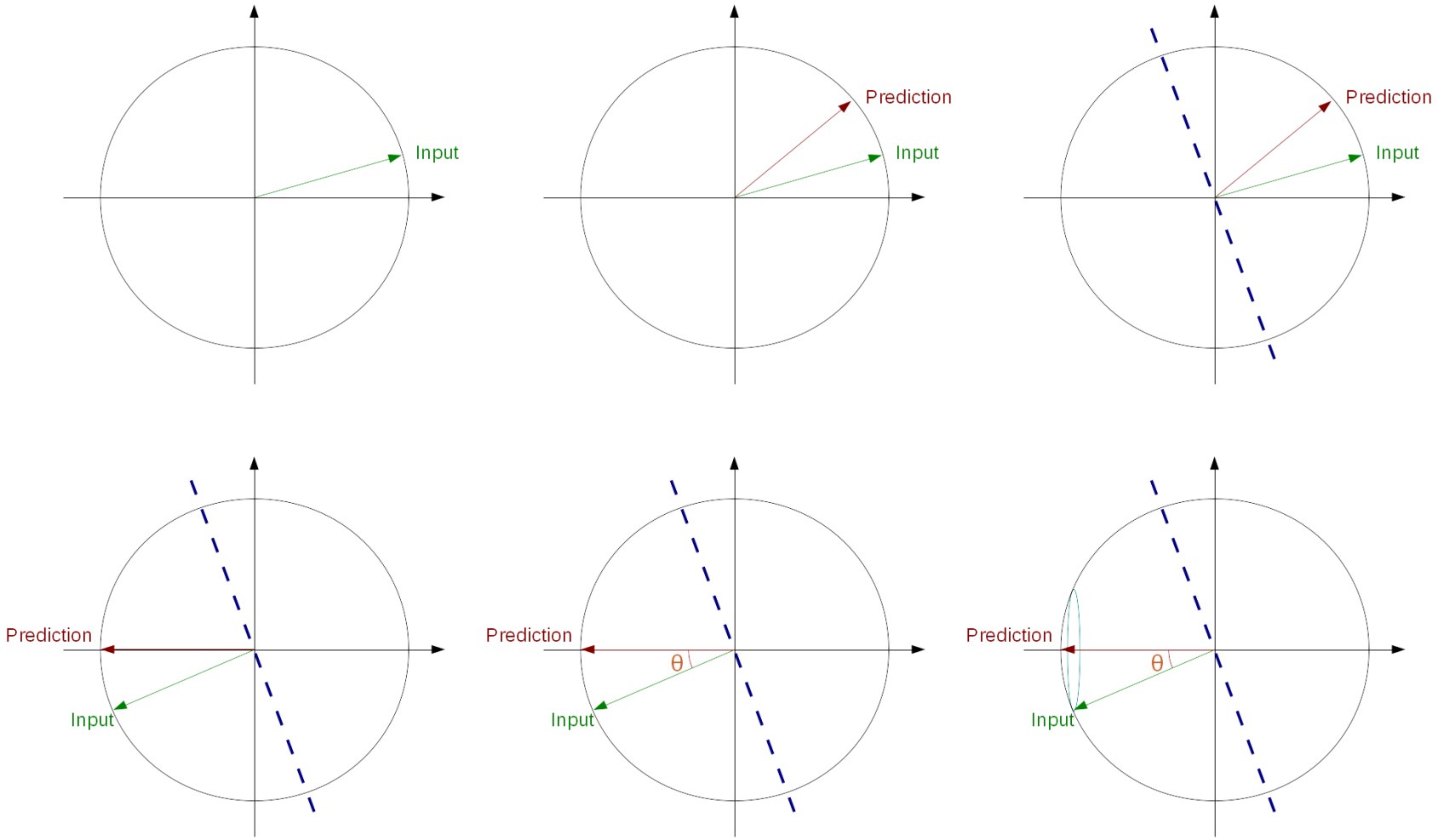
- emulate_hardware, clpf, dering, var_tx, rect_tx, ref_mv, dual_filter, convolve_round, ext_tx, tx64x64, sub8x8_mc, ext_intra, intra_interp, filter_intra, ext_inter, compound_segment, ext_refs, global_motion, new_quant, supertx, ans, ec_multisymbol, loop_restoration, ext_partition, ext_partition_types, unpoison_partition_ctx, ext_tile, motion_var, ncobmc, warped_motion, entropy, bitstream_debug, alt_intra, palette, daala_ec, pvq, cb4x4, frame_size, delta_q, adapt_scan, filter_7bit, parallel_deblocking, loopfiltering_across_tiles, tile_groups, ec_adapt, tempmv_signaling, rd_debug, reference_buffer, coef_interleave, entropy_stats, masked_tx, daala_dist, tripred

Directional deringing



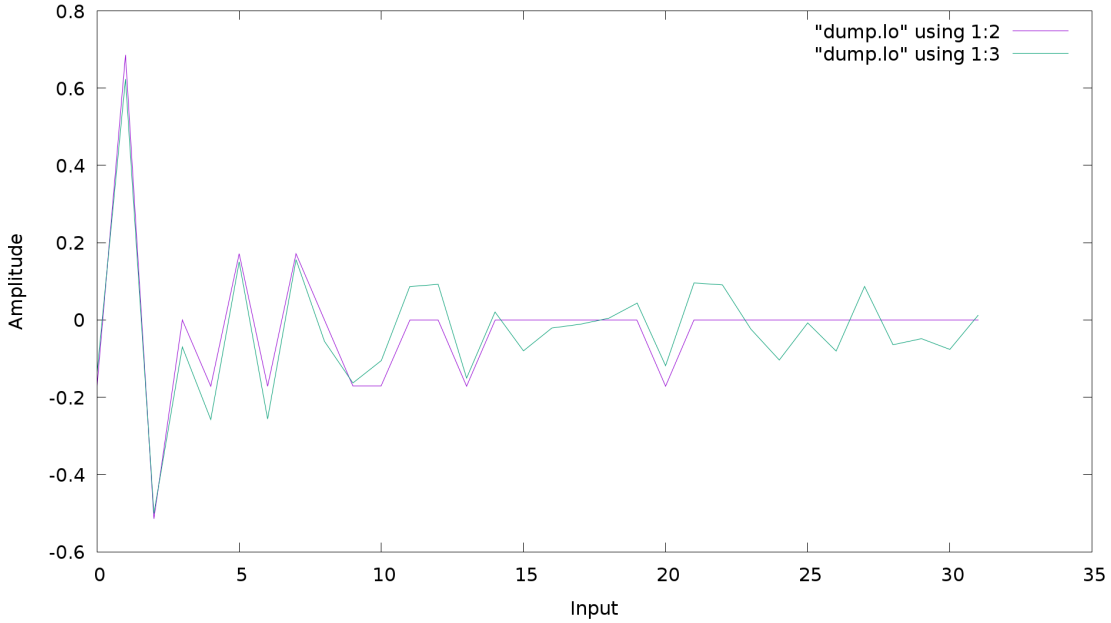
- Works on an 8x8 block basis
- Searches for the overall direction of the block
- Filters perpendicularly with decaying strength, looks for deviations

PVQ



- A big update on the stone-age scalar quantization
- Provides general frequency domain prediction and activity masking

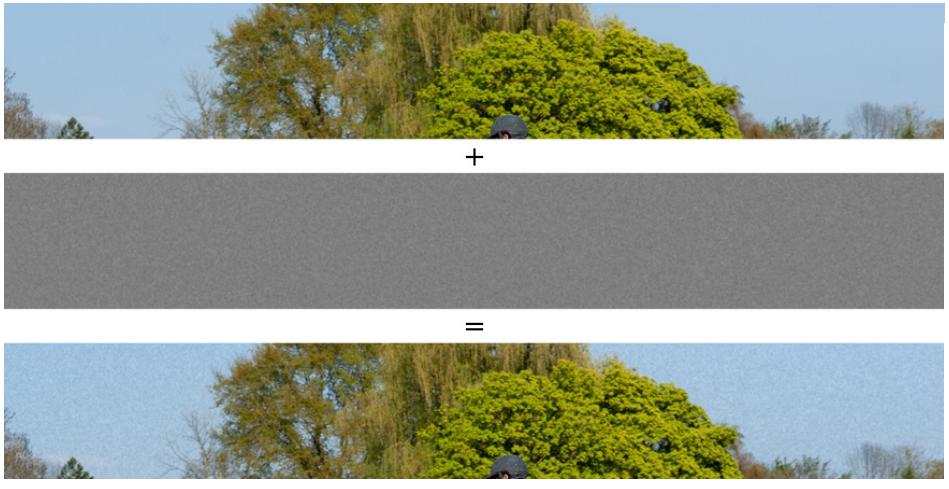
PVQ Search

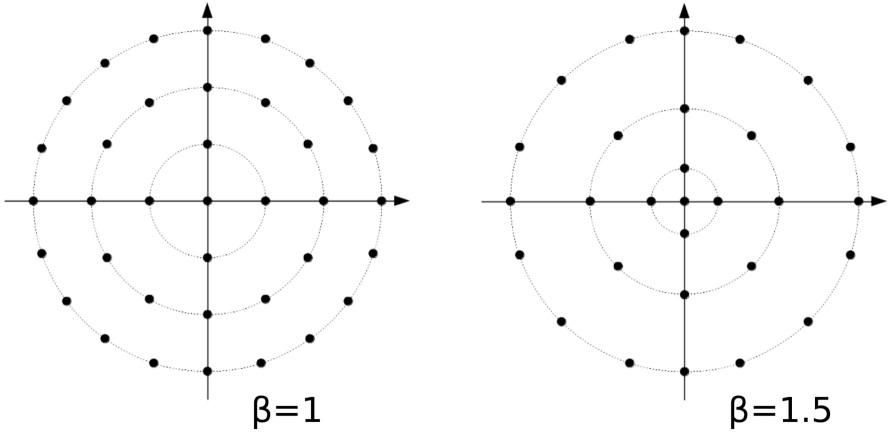


- Inputs: N - number of components in a vector, K - pulses, X - vector of N components, L2 normalized
- Outputs: y - a vector of N integer components, the sum of the absolute values must be equal to K
- Condition: When y is normalized to L2 the resulting vector should match X as close as possible

The gain and the shape are decoupled.

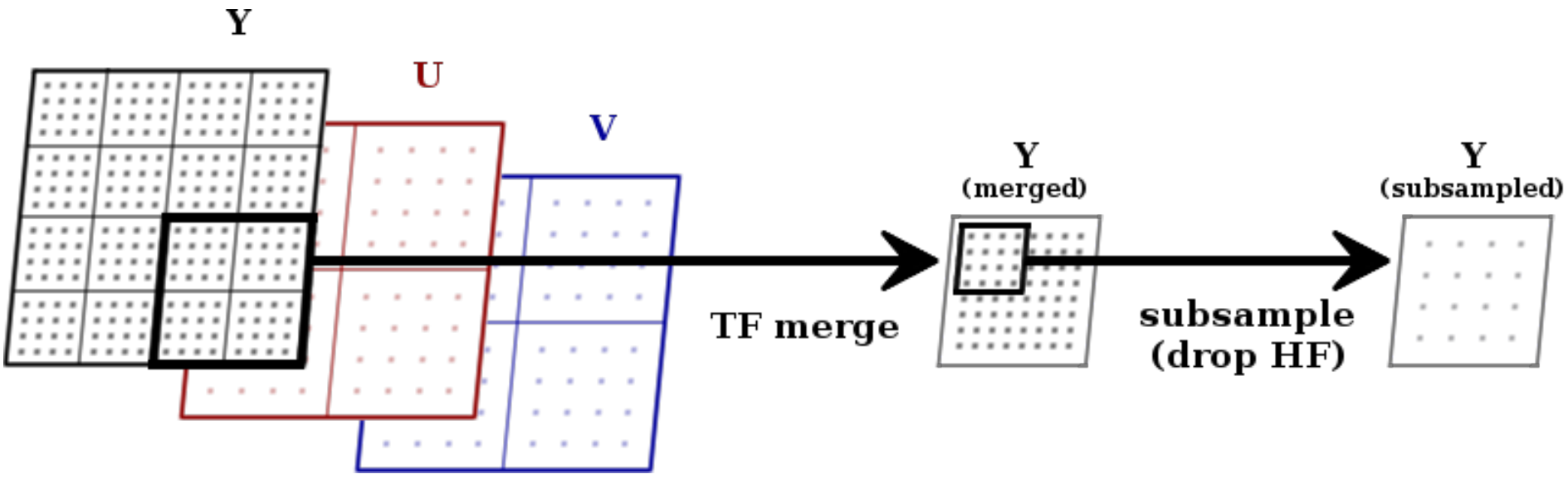
Activity masking





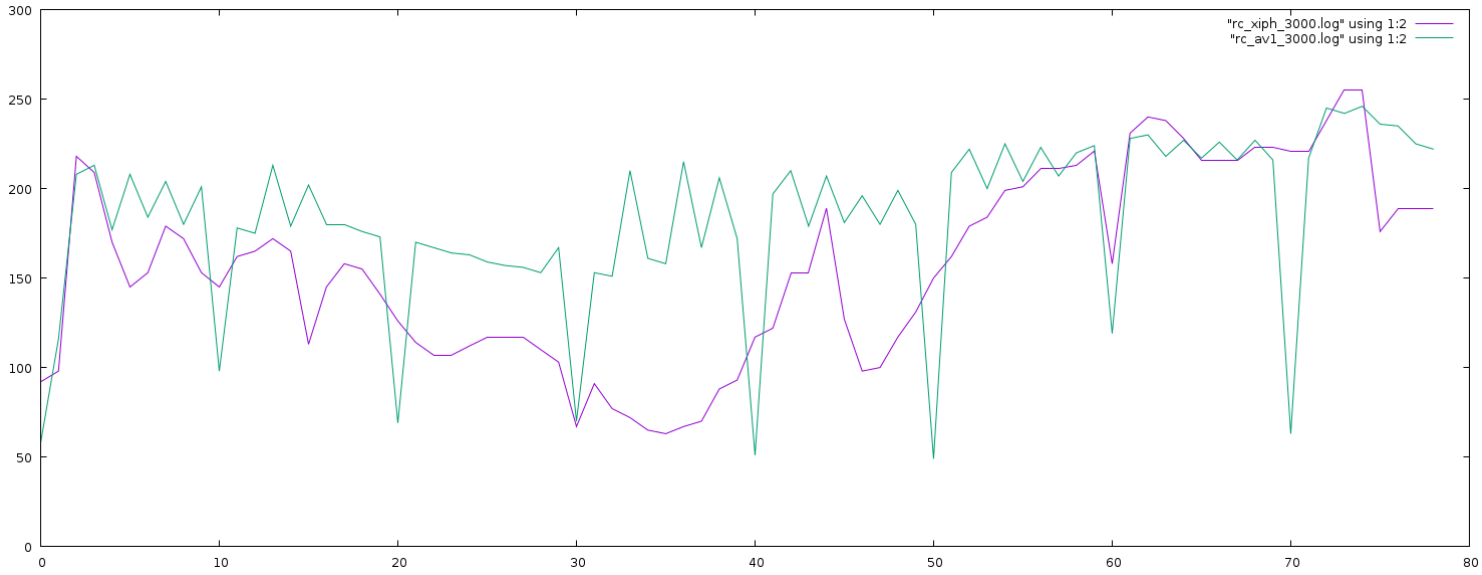
- Provides better resolution in low contrast areas
- Instead of blurring and reducing detail (HEVC's SAO oil painting art), hides quantization artifacts

Chroma from Luma



- Works in the frequency domain
- Predicts chroma coefficients from luma coefficients
- Merges Y blocks using TF if chroma is subsampled
- Only works if both Luma and Chroma planes use the same transform

Rate control



$$bits\_per\_second = scale \cdot quantizer^{-alpha}$$

- Predicts the bit usage per frame per quantizer
- *scale* gets accurately measured and updated after encoding
- Filter *scale* using a second order Bessel filter
- Extendable to two pass and chunked two pass encoding

rANS

- Fast decoding speed
- Works as a stack, encoder needs to store all symbols before reversing at the end
- Windowing rANS (restarting after some bytes) has huge overhead

Other notable mentions

- ext_tx
  - More transform types + a null transform
- Adaptive coding order
  - In case zigzag isn't necessarily the best
- 64x64 transforms

End

Questions?